Advant® OCS
with Master software

Overview

Product Guide

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Chapter 1 Advant OCS Overview

1.1 General

Advant OCS is an open, integrated and distributed system for all kind of process and industrial automation applications. It provides software solutions in all process and control areas, from small to large systems, and communication capabilities on all levels, from fieldbuses to high-speed plant network. With Advant OCS you will have the best equipment, based on the latest technology regarding functionality, interoperability and performance. All in one to increase your productivity, competitiveness and to reduce your life cycle cost. Advant OCS empowers your plant according to your wishes and demands. By choosing Advant OCS, you will be prepared for tomorrow.

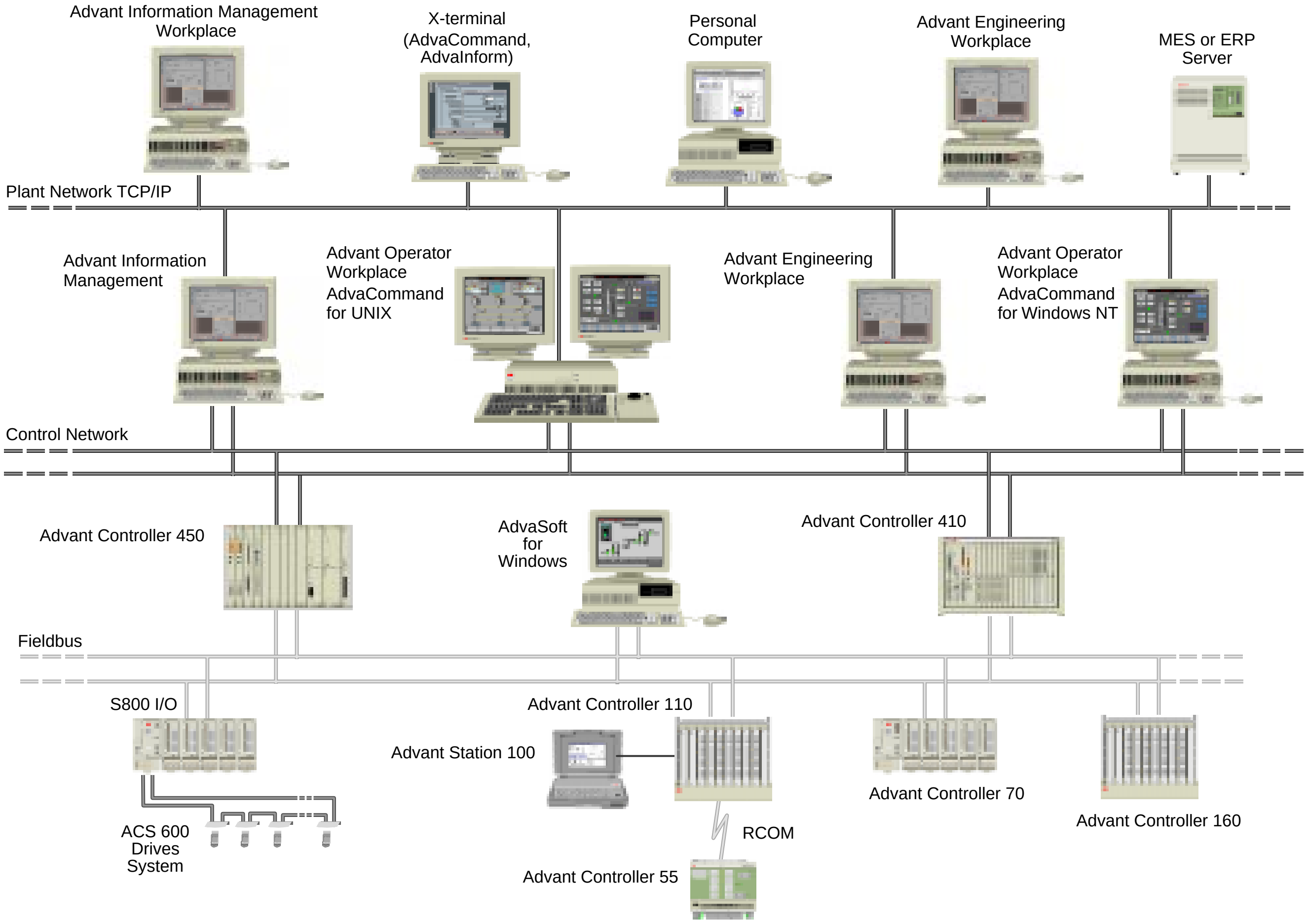


Figure 1-1. Example of an Advant OCS system configuration

Advant OCS comprises solutions regarding following aspects:

- Optimized Performance
- Quality Improvement
- Automation Engineering Efficiency
- Flexible Manufacturing
- Asset Management
- Decision Support
- Operator Effectiveness
- Environmental Management

Optimized Performance

Advant OCS provides reliable performance, consistent optimized product quality and a proven short payback period. Through improved understanding of plant performance, operators make better production decisions which increases the productivity.

Quality Improvement

While achieving consistent quality, Advant OCS reduces energy consumptions, waste, manufacturing cycle time, raw material usage which, in all, results in a lower cost of goods sold. Advant OCS solutions also provide the necessary data for information management, which is needed to meet the rigorous regulatory requirements of agencies such as the EPA, FDA and ISO certification bodies.

Automation Engineering Efficiency

Advant OCS covers a range of products and services, which improve engineering efficiency through a product's life cycle. This includes design, construction, commissioning and maintenance at a plant or mill. Advant OCS enables customers to build, manage and document changes to engineering data in an efficient manner through a single environment. This is accomplished through a single point of entry and the association of data throughout the enterprise. Using the latest technology to store and connect engineering information to efficiently deploy and maintain control solutions, Advant OCS is able to eliminate redundancies and reduce resources to keep information current.

Flexible Manufacturing

Advant OCS is engineered and configurable to allow process manufacturers to achieve flexible manufacturing and reduced production cycle times. The use of flexible control languages and procedures enable the reduction of latency delays between production runs and production steps. Through the use of recipe management integrated speed controls and advanced scanning techniques, manufactures can make fast and accurate grade changes and production runs.

Asset Management

Advant OCS has been designed according to the importance and maintenance on reduction of life cycle costs of an automation solution. The goal is to provide customers with higher productivity, better quality output and lower life cycle costs.

Decision Support

Advant OCS enables access to plant floor information from a variety of systems, which together with an understanding of the process manufacturing boils down to better informed and more timely decisions.

Operator Effectiveness

Advant OCS provides information displays and tools, which allow the operator to run the plant effectively. Standard operating procedures and rules are embedded into the system and are then readily available for the operator. Intelligent alarm management, prompt handling of the process upsets through alarm and event handling is among other things an Advant OCS operator solution is able to offer. Effective use of information allows the operator to proactively manage the process through the transformation of vast amounts of data into useful information.

Environmental Management

Environmental management requires today a proactive look at environment compliance costs and improvement opportunities. The base of Advant OCS is designed and developed with the intention to help our customers making continuous improvements, which will give maximize return on investments. As process and business decisions require more integration with environmental management and ISO 14000 compliance, this issue is and will be of high importance and the fact is with Advant OCS you will have peace of mind concerning the care of the future.

1.2 Features

Advant OCS covers a wide range of features which will contribute to decrease your cost, such as:

- A self configuring Control Network allows nodes to be dynamically added without configuration work
- Redundancy at all levels will increase the availability
- Remote engineering support allows you to debug and install applications from distance
- Ready made solutions and re-use support in the engineering phase will shorten configuration time
- Field bus support brings your field instruments not only into your control strategies but also onto your operator screen and into your asset managagement system
- Open interfaces at many levels allow integration with other environments and allow other application to read and write data into the automation system
- Distributed object access and dynamic resolution of tag names makes the foundation for a distributed control system, and makes it possible to add new applications, displays, etc that access data, without affecting already running applications
- A modern graphical operator environment including all functions you expect to find, will contribute to your operator's efficiency
- Object displays available at the operator screen once an object is created anywhere in the system makes commissioning and future changes and add-ons easier
- Integration of fixed and varible motor drives shortens engineering and increases control and supervision quality
- A highly reliable hardware gives you high up-time and exellent resistance to electromagnetic interference

1.3 Advant OCS Product Scope

Advant OCS include product families for:

- Engineering
- Operator Interface
- Process Control
- I/O systems
- Electrical Control
- Information Management
- Communication.

There are several standardized, fully tested and documented products in each family. All products are parts of large system configurations. Each product is structured as follows:

- Basic unit
- Options
  - Software
  - Hardware
  - Combined software and hardware
- Packaging.

A basic unit has a certain functionality which can be extended by adding hardware, software, or combined options as required. Some options requires that other options are installed.

Process Control

Process control with a range of controllers, ranging from small PLC units for a maximum of 64 I/O channels to advanced controllers for logic and regulatory control with as many as 5700 I/O channels per station.

Operator Interaction

Operator interaction by means of Human Machine Interface, HMI, equipment, ranging from low-cost, monochrome video terminals, to advanced operator stations featuring the latest technology in user interfacing, that is, high-resolution color graphics and windowing based on industry standards, such as X Window System and OSF/Motif.

Engineering

Engineering is supported by engineering stations and software packages for tasks such as configuration, documentation and fault tracing. Off-line engineering as well as on-line configuration is fully covered.

Information Management

Information management is supported by powerful functions providing the right information for decision-making. An open platform allows for inclusion of standard or proprietary applications, for example, for production planning, optimizing control, or administration. True plant-wide information integration capabilities are obtained through the use of open technology, including TCP/IP, SQL, DDE, and X Window System.

Batch Control

Batch control is covered through standardized, ready-to-use functions for control of different types of batch processes. Batch stations efficiently manage recipes, materials, storage locations, production orders, and processing equipment and provide intelligent batch routing, process supervision, and reporting.

Communication

Communication features fieldbuses as well as wide and local area networks, with a set of data links, catering to different requirements, and communication stations for connection to external computers and communication networks, as well as connecting control networks to the plant network.

1.4 Advant OCS Philosophy

The following key words summarize the system philosophy of Advant OCS:

- Integration
- Distribution
- Reliability
- Openness
- User Friendliness
- Investment Security and Expandability.

The following sections provide details on how this is realized in the Advant OCS system.

Integration

The basic principle of the Advant OCS concept for industrial automation is functional, structural and informational integration.

- Functional integration

  the same products and concepts are used in a uniform manner for all kinds of control, including logic, regulatory and supervisory control.

- Structural integration

  all products, from small controllers close to the process to advanced operator stations for central control, are parts of a system which is expandable step by step, from small scale to plant-wide automation.

- Informational integration

  the automation system is seen as an integrated part of the total computing environment at a plant. Thus information can easily be shared and distributed between all parts of an operation.

Distribution

The system consists of controllers, workplaces and batch stations. The real-time process data base is entirely distributed to the controllers. These are functionally complete and able to perform logic control, regulatory control and advanced calculations. This ensures that all processing and control can be performed on the spot, that is, data does not have to be sent elsewhere for processing and return of the result. Consequently, the control system can be structured according to the process requirements without restrictions imposed by limitations in the control system. The result is a “clean” structure with a high degree of integrity.

The operator stations contain the information on how to present and manually control the process. They have access to the process data base through the local area network. Advant OCS utilizes symbolic addressing, that is, measurement points, control circuits, and output points are identified by name as opposed to numeric indices. This makes it possible for control engineers, application programmers, operators, and maintenance people to speak the same language.

The data base in the information management station systems is accessible throughout the system, in the same way as the real-time process data base, allowing powerful information integration. There are also services providing access to data in any computer, connected to the plant network and offering SQL*Net services, as if the data was shared in the local data base. The real-time process data base is accessible from the plant network via standard SQL and DDE services. Geographical distribution is catered for by a fieldbus, to which distributed I/O units, controllers and variable-speed drives can be connected. Telecommunication protocols offer communication capabilities over telephone lines. In order to extend the control network over long distances, communication bridges, radio links and even satellites can be employed.

Reliability

Advant OCS equipment is characterized by extreme reliability and availability and is designed to work in industrial environments. However, despite all reasonable precautions, malfunctions can occur. That is why the parts and functions of the system are monitored automatically and continuously and any faults or problems are reported.

In some cases, extremely high availability is required in parts of, or for the entire control system. To meet such requirements, critical parts at all levels of Advant OCS can be duplicated. In controllers, the central unit (CPU and memory), communication units, I/O channels, and power supplies can be duplicated. The communication network can be equipped with dually redundant links and alternative-path selection to maintain communication at all times, even if individual links drop out. Operator stations and information management stations can be entirely duplicated or supplemented with simpler equipment for backup.

Openness

Open technology and standards, both industry and international, ensures Advant OCS provides powerful, easy to use, openness. Examples of important standards and their relevance are:

- **SQL - Structured Query Language** - a standard for accessing information from databases. Through AdvaInform SQL*Connect, most information in Advant OCS is accessible using SQL. Data can also be accessed from external computers via SQL. Information, accessible via SQL*Net, can be integrated in process displays or used in control programs.
- **X Window System** - a protocol allowing users to interface with applications in other computers from windows in their own computer, or from an X-terminal. In Advant OCS it can be used to give access to control the process from an X-terminal or, for example, access to circuit diagrams from an engineering station. The operator can even get access to an expert system for process optimization, by opening a window in the operator station.
- **OSF/Motif** - a standard defining how window applications are to interact with users. In Advant OCS, displays and dialogs are based on OSF/Motif, whenever possible. This results in a consistent and easy-to-use user interface.
- **DDE - Dynamic Data Exchange** - a standard to exchange data between MS-Windows applications. A DDE server capability gives access to the real-time process data base via DDE. This means dynamic access to real-time process information from packages such as Word for Windows, Excel, or Paradox.
- **OLE/COM** -a standard to exchange data between MS-Windows applications. For example, trend data in AdvaInform Display can be copied into MS-Excel or MS-Access.

User Friendliness

Advant OCS has been designed with the end user always in mind. It is a dedicated automation system which means that users do not have to be computer experts. Instead they can concentrate on specifying and implementing the control schemes they need in a familiar notation, in order to produce top quality products at the lowest possible cost.

The user interface is consistent throughout the product range. This pushes the learning curve down, even if the range of duties given to operators is expanded at the same time. It is always easier to make the right choice of action than the wrong one.

Engineering is done by configuring instead of programming. Graphically represented function blocks manage the most demanding control tasks and process graphics are created using the most modern tools available.

The communication system is self configuring. This means that the user only has to connect the stations together physically, while the system itself maps out the topology of the network and establishes the required communication paths through it. This is particularly important for large systems and when expanding existing installations.

Investment Security and Expandability

To safeguard investments in Advant OCS for the future, ABB has a long-term commitment to compatibility.

Advant OCS enables users to start with small-scale control systems and later expand them step by step into systems covering the whole plant, or even plants.

The first steps may involve control of single machines and process sections. The next step may be to connect the separate control systems to a communication system and to add functions for joint control. A final step might be to introduce central control rooms with advanced operator stations, and perhaps even to connect several, separate control systems into a plant-wide network.

This expansion process is possible without any modifications to the equipment already installed, except for the additions necessary to connect to, and communicate with, the new equipment. For example, a new controller connected to MasterNet is automatically adopted by the communication network. Symbolic references from an operator station to objects in a new station are automatically resolved. To the extent applicable, the user only needs to add the new displays required in the operator station and define the signals in the existing controllers, which are to interact with the new station. The communication functions are effectively isolated from the application programs, making it easy to extend or restructure an Advant OCS system without rewriting any programs.

System Upgrades

ABB provides its clients with an open automation platform that can be expanded as the plant grows, thus minimizing overall life-cycle costs. Advant OCS consists of universal components that provide users with a step-by-step path for system expansion. ABB is committed to provide compatible automation solutions that protect initial investments and ensure flexibility.

The Advant OCS system´s step-by-step expansion capability allows users to add new functionality without making existing equipment obsolete. The system´s self-configuration capabilities eliminates the need for engineers to establish communication paths when a new station is physically installed. New units can often be added even while the rest of the system is in full operation. With the Advant OCS, system expansion is easy and cost-effective.

Both the hardware and software of the Advant OCS system are continually updated with new features and functions to keep it on the leading edge of technology. New capabilities are offered to existing users in the form of an upgrade to bring the installed system up to the latest version available. The availability of the upgrade protects your investment in hardware, software, and, often most importantly, application software.

Compatibility Policy

ABB is a leading supplier of OCS systems. As such we have a responsibility towards our customers, old as well as new. This is why we have a commitment to safeguard investments in our technology and products. This commitment means that backwards compatibility always is considered before and during new developments. The rational for this is to preserve investments made by our customers in their use of our products, but also our own investments in marketing and applications.

The concept of step-by-step automation thus forms an important part of the business idea of ABB. This concept means that we provide a product family which in itself permits a gradual expansion of an installation and that this expansion also will be possible over a longer period of time.

In practice this compatibility commitment means the following:

- Products of different versions, within the same control network as well as between separate control networks, will be able to communicate with each other.
- Application software will be possible to transfer from older to newer versions of Advant OCS products with a minimum of manual work.
- The resulting functionality, when products from different versions are mixed is normally restricted to the largest common functionality.

Changing market requirements as well as emerging technologies will make more or less radical, technological generation shifts necessary. This will occur with certain, longer time intervals. Also in these cases the compatibility policy will be observed.

Chapter 2 Advant Engineering Products

Advant Engineering Products implement ABB's approach to a scalable automation project engineering. From the independent products needed for quick and efficient controller configuration, for example AMPL Control Configuration, to Advant Engineering Workplace which serves as an integrated platform for all the tools needed to manage, design, engineer, install, commission and maintain industrial automation plants with Advant OCS with maximum productivity and quality. The smaller independent products easily integrate into the total concept which addresses the needs of both the engineering and maintenance phases, which means that it offers important benefits to both application development and plant maintenance engineers.

2.1 Product Benefits

Advant Engineering Products support the different tasks in the engineering process. They do so by letting individual products be combined to fit the team of persons working with the whole range of the engineering, from single controller configuration to projects handling for a complete plant.

Object Oriented Engineering

The Advant Object concept is the common base for the set of tools providing efficient engineering methods to support process automation projects. Each project can be broken down into smaller and smaller components called Advant Objects. At the low level of the project structure these Advant Objects can be individual signals, connection terminals, motors, etc. Advant Objects are filled with information that describes different aspects of the corresponding real world object. These Aspects range from CAD drawings and functional descriptions to control programs. For easy access to the information there are different Views on the Aspects. The ability to include dynamic data in the Aspects gives the concept a very high flexibility.

The fact that Advant Engineering Products and its components support this concept gives the engineer the means to handle projects of different size and scope in an efficient manner while maintaining high quality standards. Import of existing data into the engineering environment is well covered, allowing coexistence with existing tools and methods. To achieve a high engineering efficiency and quality one time data entry is supported.

Teamwork

Advant Objects promote teamwork of qualified personnel from different areas. By supporting multiple access to Advant Objects it is possible for several engineers to work with the Aspect of their speciality on the same object at the same time. By using the licensing flexibility, the individual workplaces can be tailored according to the needs of each engineer in the team.

Reuse

Engineering becomes more efficient when using Advant Objects. This is mainly due to good reuse support and extensive import functionality. Dynamic solutions in libraries can be merged with new engineering data., thereby creating completely new applications for the current project.

Lifetime Information Support

When the engineering is done and the plant is started, Advant Engineering Workplace acts as an excellent information data base. The possibility to add more Aspects to an Advant Object makes it is easy to keep the information updated and collect all the relevant information, about the object, in one place. This gives a certainty that, when needed, the information is accessible and complete.

Advant Engineering Products are designed to help engineers build and maintain industrial automation plants more efficiently, at lower costs and with better engineering quality. It does so by providing an integrating platform for all the disciplines, tools and tasks involved, throughout the life cycles of these plants. In short, Advant Engineering Products helps industrial automation engineers do a better job faster.

2.2 The Advant Engineering Products

There are packages within Advant Engineering Products each built up by different tools. The tools, called Builders, are used for efficient entry of engineering data and graphical application programming of controllers. Since documentation is an important part in a project, functions for creation, managing, and printing of project documents are available. For electrical diagram handling there are products based on AutoCAD. There are also durable industrial PCs ideal for fieldwork.

Products which support Advant Objects running on Windows NT

- Advant Engineering Workplace, serves as a cooperation base for the engineering products
- AMPL Control Configuration, for configuration of Advant Controller 100 and 400 Series
- Computer Aided Electrical Engineering, for electrical CAD engineering
- Advant Station 100 Series Engineering Station, a durable PC for field work

NOTE

The minimum setup needed to configure an Advant Controller is AMPL Control Configuration.

2.3 Advant Engineering Workplace

Advant Engineering Workplace establishes the engineering environment for the AdvaBuild Engineering Software under Windows NT.

Further engineering products can be added and extend the basic functionality of the Advant Engineering Workplace. Together they can be run in a cooperating mode, Figure 2-2. These products are:

- AMPL Control Configuration
- Computer Aided Electrical Engineering (CAEE).

NOTE

The two products above are stand-alone products as well. Advant Engineering Workplace is not needed to run either of them but in the cooperating mode there is more functionality and advantages, Figure 2-1 and Figure 2-2.

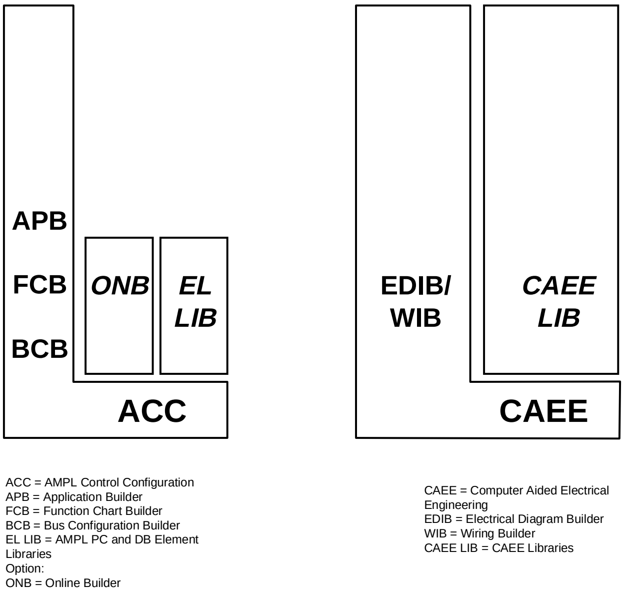
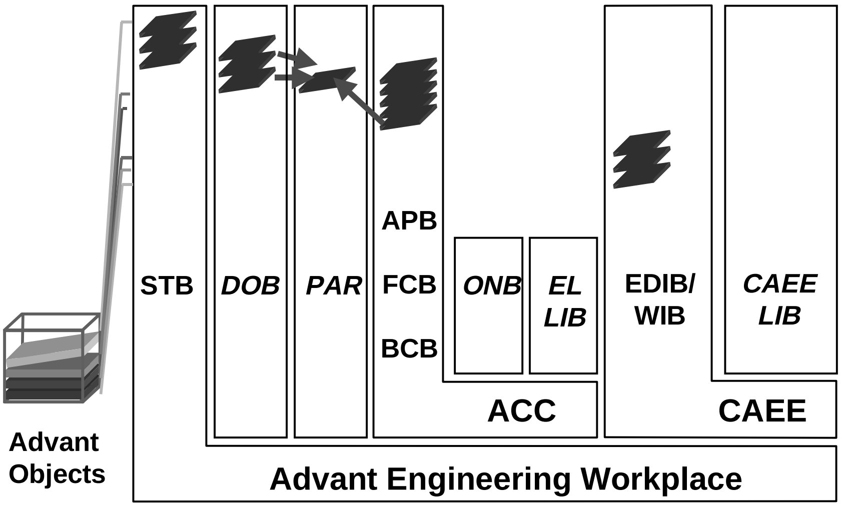

APB
FCB
BCB
ONB
EL LIB
ACC
EDIB/ WIB
CAEE LIB
CAEE
ACC = AMPL Control Configuration
APB = Application Builder
FCB = Function Chart Builder
BCB = Bus Configuration Builder
EL LIB = AMPL PC and DB Element Libraries
Option:
ONB = Online Builder
CAEE = Computer Aided Electrical Engineering
EDIB = Electrical Diagram Builder
WIB = Wiring Builder
CAEE LIB = CAEE Libraries

Figure 2-1. ACC and CAEE in independent mode



STB = Structure Builder
Options:
DOB = Document Builder
PAR = Parameter Builder

ACC = AMPL Control Configuration
APB = Application Builder
FCB = Function Chart Builder
BCB = Bus Configuration Builder
EL LIB = AMPL PC and DB Element Libraries
Options:
ONB = Online Builder:

CAEE = Computer Aided Electrical Engineering
EDIB = Electrical Diagram Builder
WIB = Wiring Builder
CAEE LIB = CAEE Libraries

Figure 2-2. Advant Engineering Products in cooperating mode

Two options which extend the functionality of Advant Engineering Workplace are available, Figure 2-2:

- Option Parameter Builder which handles the import and editing of engineering data used as parameters by the other AdvaBuild Engineering Software products.
- Option Document Builder which integrates office tools like Microsoft Word and Microsoft Excel with Advant Engineering Workplace. It also offers a document registry based on Microsoft Access. These features gives the user an excellent tool for the creation and administration of documents.

2.3.1 Product Benefits and Features

Some features of Advant Engineering Workplace, in cooperating mode together with the options:

- Multiple Structuring, that is, different views of the project
- Filter functions for easy retrieval of data
- Copy/Paste of Advant Objects including all its Aspects
- Automatic creation of parameterized Advant Objects from libraries and spread sheets gives extensive reuse support
- Dynamic documents, automatically updated when duplicated and given to another Advant Object
- Flexible parameter handling, where parameters are available for other Aspects
- Auto generated reports
- I/O allocation
- Printing

2.4 AMPL Control Configuration

AMPL Control Configuration is a suite of builders necessary to configure Advant Controller 100 and 400 Series with Master software. The products are based on Windows NT.

The option On-line Builder extends the functionality of AMPL Control Configuration by support of on-line configuration and download of Advant Controller 400 Series applications.

The set of available elements for Function Chart Builder is determined by libraries. AMPL PC and DB Element Libraries include the PC and DB Element Libraries and reference manuals for Advant Controller 400 Series (Advant Controller 410 and Advant Controller 450) and Advant Controller 100 Series (Advant Controller 160, Advant Controller 110, Advant Controller 70 and Advant Controller 55).

2.4.1 Product Benefits and Features

AMPL Control Configuration provides the following features:

- Administration of nodes, Circuits and Type Circuits simplifying project start-up and reuse
- Off-line editing with powerful cut/copy/paste
- On-line editing for rapid program modifications
- Target system control for easy testing of installed system
- Module diagnosis

In cooperating mode it supports much more features like:

- Support for the Advant Object concept including
  - parameterized data in Type Circuits used in Circuit aspects and DBElement aspects
  - efficient commands acting on sets of these aspects

2.5 Computer Aided Electrical Engineering

Electrical Diagram Builder - Wiring Builder is available for creation and administration of circuit diagrams, loop diagrams, connection diagrams, layout diagrams, I/O diagrams and overview diagrams and efficient handling and documentation of the plant wiring.

As addition, CAEE Libraries contains symbol libraries and format libraries.

2.5.1 Product Benefits and Features

Computer Electrical Engineering provides, in cooperating mode together with the options, the following features:

- Support for the Advant Object concept including parameterized data
- Effective symbol handling for better reuse
- Extensive drawing help which shortens drawing time
- Semi-automatic allocation of connections to cables reduces work and mistakes
- Effective article import via standardized format to reduce work and mistakes
- System neutral, standardized description of engineered data to be imported and used by the customer’s maintenance system

2.6 Advant Station 100 Series

Advant Station 100 Series Engineering Stations

Advant Station 100 Series Engineering Stations are durable PCs which satisfy the Advant OCS environmental specifications. Advant Station 100 Series Engineering Stations are ideal for fieldwork, including off-line engineering, on-line programming, maintenance and fault tracing.

The Advant Station 100 Series Engineering Stations are available in 2 different variants:

- Advant Station 120 Engineering Station for Windows NT (PCI)
- Advant Station 130 Engineering Station for Windows NT (ISA)

Advant Station 100 Series Engineering Boards

Advant Station 100 Series Engineering Boards allows the use of an appropriate IBM compatible PC together with AMPL Control Configuration products for on-line configuration of Advant Controller 400 Series. This will give a similar functionality to an Advant Station 100 Series Engineering Station.

The Advant Station 100 Series Engineering Boards are available in 2 different variants:

- Advant Station 100 Series Engineering Board (ISA)
- Advant Station 100 Series Engineering Board (PCI), which allows in addition direct connection to MasterBus 300.

2.6.1 Product Benefits and Features

In addition to the benefits and features for AMPL Control Configuration, Advant Station 100 Series Engineering Stations are very sturdy and can handle the rough treatment in the field. In a less hostile environment a PC together with any of the Advant Station 100 Series Engineering Boards can be used. If the Advant Station 100 Series Engineering Board (PCI) is used the configuration work can be made from the office via MasterBus 300.

Chapter 3 Advant Operator Interface Products

Advant Operator Workplace -with software AdvaCommand for Windows NT and AdvaCommand for UNIX- represents a new approach to supervision and control of industrial processes. It does not only provide the capability to communicate with the process but also with other computers and systems outside the automation system. This information integration capability makes it possible to view both administrative data and process control data on the operator workplace.

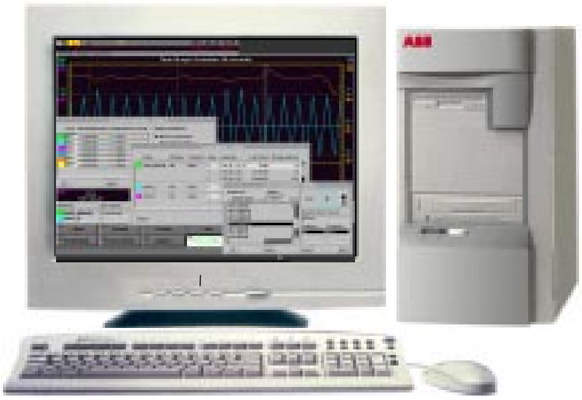


Figure 3-1. Advant Operator Workplace, AdvaCommand for Windows NT

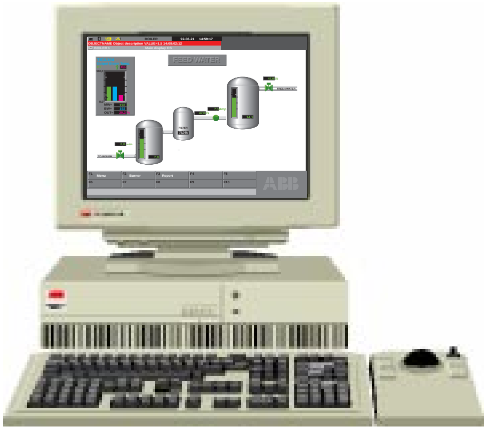


Figure 3-2. Advant Operator Workplace, AdvaCommand for UNIX

3.1 Product Benefits

Advant Operator Workplace can be connected to MasterBus 300 control networks, and communicate with Advant Controller 400 Series as well as with Advant Information Management Workplaces.

Advant Operator Workplace complies with the X Window System and the OSF/Motif® standards, making it possible to access and run applications in other stations throughout the network. For instance, to look up circuit drawings created and stored in an engineering station or view and edit data in product quality and business information systems.

Operator Interaction

Operator interaction by means of Human Machine Interface (HMI) equipment, ranging from low-cost to advanced operator workplaces featuring the latest technology in user interfacing, that is, high-resolution color graphics and windowing based on industry standards, such as X Window System and OSF/Motif.

3.2 Features

Some features of the Advant Operator Interface Products are:

- High resolution displays for presentation of process data.
- Trend presentation of historical data.
- Command entry to the process via mouse and keyboard -AdvaCommand for Windows NT
- Command entry to the process via mouse/trackball, function keyboard or a combination of both -AdvaCommand for UNIX
- Process alarms and events are time-tagged and presented for the operator in alarm and event lists and can also be announced audible to make the operator aware of it.
- Event messages and alarms can be grouped and gated in multitude of ways, ensuring that only relevant and primary events are brought to the operator’s attention.
- System status displays provides status information about the automation system with regards to all communication links, stations, peripheral equipment and process I/O boards.
- Process sectioning provides functions for dividing the process into sections and linking each workplace to the desired mix of process sections for supervision and control.
- Status lists is a list of process signals and objects matching search parameters supplied by the operator. Status lists are used to find process objects that are in a certain state or have something in common, for example, all blocked PID objects.
- Display Builder supports the creation of free-image displays for interactive monitoring and control.
- Station Backup function is used to backup applications in the own station.
- On-line Builder. Process controllers can be configured, debugged and documented on line from a window in the operator workplace.

- Trend presentation of historical data
- Central Backup function is used to backup applications in other stations of the system such as process controllers -AdvaCommand for UNIX.
- AdvaInform History. History is used for collection and long time storage of process data on the hard disk. These data can then be presented in Trend displays -AdvaCommand for UNIX.
- Display Distribution Services is used to manage displays in large networks. With this tool it is possible to have the display source code on one operator station and allow distribution of different sets of displays to any other operator station within the network.

Chapter 4 Process Control

4.1 Advant Controller 450

Advant Controller 450 is a high-end, high performance process controller for binary, regulatory and supervisory control. Its high processing capacity and wide-ranging process and system communication capabilities make it the ideal choice for demanding applications in industrial environments, either standing alone or as an integrated part of an Advant OCS system as well as in any other distributed control system

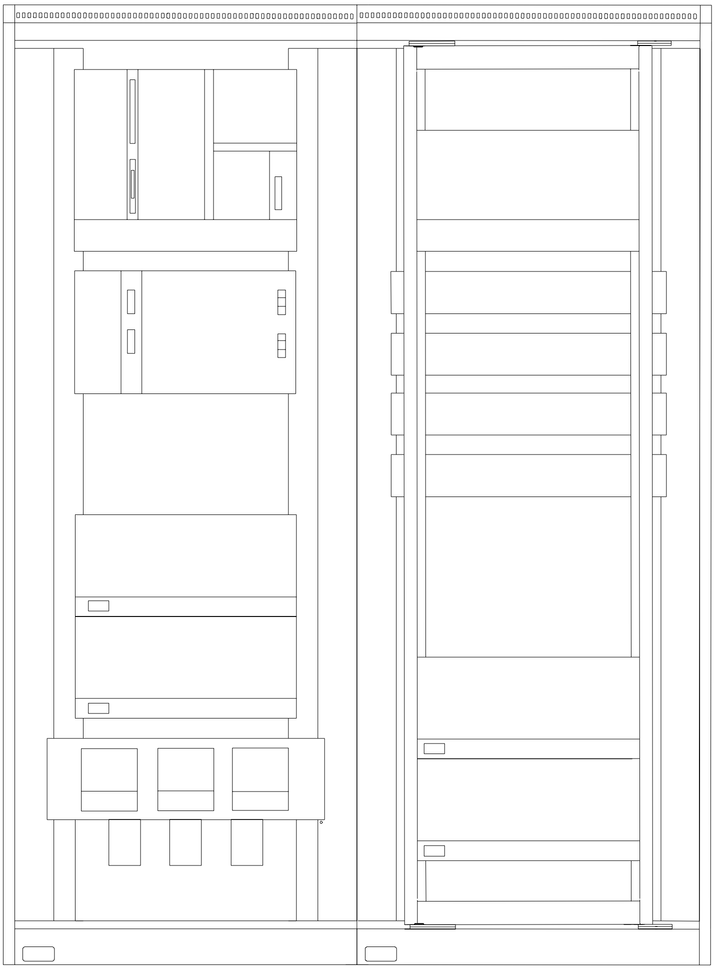


Figure 4-1. Advant Controller 450 with S100 I/O in RH500 Cabinets

Product Benefits

With Advant Controller 450 you will have the latest equipment concerning functionality, interoperability and performance. An increased availability is achieved by using dual redundant processor modules, dual redundant voltage regulators and mains supplies. You will be able to maximize your productivity and at the same time be prepared for easy integration of tomorrow’s technology. Advant Controller 450 meets a user’s requirement of maximum plant availability.

Features

Advant Controller 450 covers a wide range of functions such as:

- Logic and sequence control.
- Data and text handling.
- Arithmetic, reporting and positioning.
- Regulatory control including Fuzzy control, advanced PID and self-tuning adaptive control.
- Highly extended flexibility and scalability - hardware as well as software.
- Fully modular with a controller subrack based on FB+ (IEEE 896) as the system bus.
- Self-configuration capabilities which make it possible to add units while the controller is in full operation
- Support of a wide range of central and distributed I/O modules for maximum configuration possibilities, with a maximum I/O capacity of 5700 I/O points.
- Support of local and central HMI for manual control operations, event and alarm handling, trend curve presentation etc.
- Interoperability concerning all communication levels from plant floor fieldbuses to high-speed plant network.
- Support of redundant Fieldbus Communication with Advant Fieldbus 100.
- Support of Advant Fieldbus 100 with cable length up to 12900 m (11800 yard).
- Support of PROFIBUS-DP and LONWORKS.

4.2 Advant Controller 410

Advant Controller 410 is a medium sized process controller for binary, regulatory and supervisory control. Its wide-ranging process control and communication capabilities make it the right choice for medium-sized, but functionally demanding applications in industrial environments, either standing alone or as an integrated part of an Advant OCS system as well as in any other distributed control system.

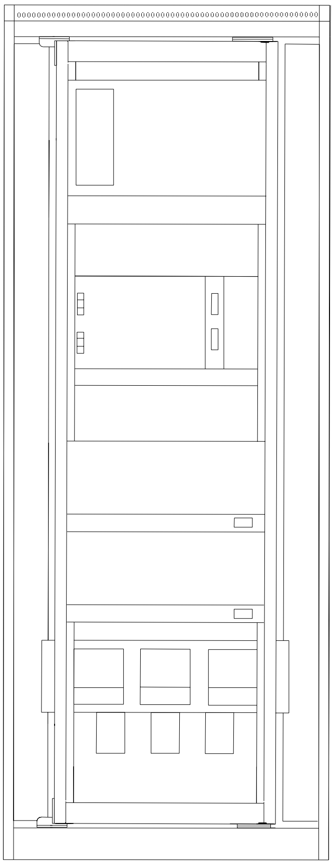


Figure 4-2. Advant Controller 410 with S100 I/O in a RH500 Cabinet

Product Benefits

Advant Controller 410 is a full-function process controller in a minimal hardware configuration. You will have the latest equipment concerning functionality, interoperability and performance. You will be able to maximize your productivity and at the same time be prepared for easy integration of tomorrow's technology at a reasonable cost.

Features

Advant Controller 410 covers a wide range of functions such as:

- Logic and sequence control.
- Data and text handling.
- Arithmetic, reporting, positioning and regulatory control.
- Highly extended flexibility and scalability - hardware as well as software.
- Self-configuration capabilities which makes it possible to add units while the controller is in full operation
- Support of a wide range of central and distributed I/O modules for maximum configuration possibilities, with a maximum I/O capacity of 4300 I/O points.
- Support of local and central HMI for manual control operations, event and alarm handling, trend curve presentation etc.
- Interoperability concerning all communication levels from plant floor fieldbuses to high-speed plant network.
- Support of redundant Fieldbus Communication with Advant Fieldbus 100
- Support of Advant Fieldbus 100 with cable length up to 12900 meter (14100 yards).
- Support of PROFIBUS-DP and LONWORKS.

4.3 Advant Controller 160

Advant Controller 160 is a scalable high performance modular controller for midsize applications including logic and regulatory control with full redundancy and multi-processing capabilities. It is offering a full complement of control functions and it is designed to suit a wide range of industrial applications, from small to medium-size, from logic to loops, either stand-alone or as an integrated part of an Advant OCS system as well as in any other distributed control system that requires redundancy.

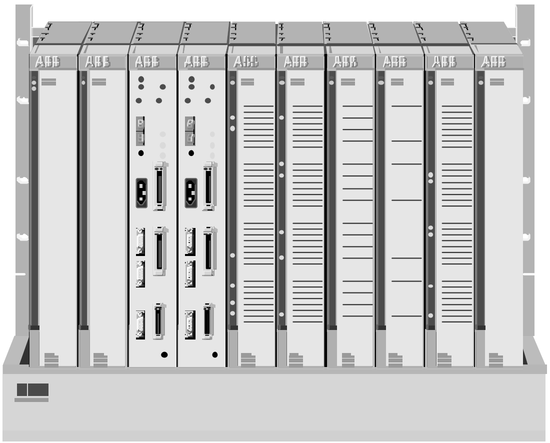


Figure 4-3. Advant Controller 160

Product Benefits

Advant Controller 160 is specifically designed for high-speed PLC-type applications, but brings also considerable problem-solving power to analog signal handling and arithmetic applications. It is perfect to live and grow with, thanks to its multitude of expansion possibilities and its on-line programming capability. Advant Controller 160 also includes handling of analog signals for loop control, binary and arithmetical application and it is designed to operate in demanding industrial environments that require redundancy at low cost.

Features

Advant Controller 160 covers a wide range of features such as:

- Multi-processing with up to 6 Processor Modules.
- Redundancy for all major components: Processor Modules, Power Supply, I/O Stations, Fieldbus interfaces (including cable redundancy).
- Rack-based and distributed I/O with a recommended maximum capacity of some 1,500 I/O points.
- Logic, sequence and PID control; arithmetic, pulse counting and regulatory control.
- Interoperability concerning all communication levels from plant floor fieldbuses to high-speed plant network.
- Hot replacement of all modules.

- Password protection of application and network access.
- True sequential event recording thanks to accurate at-the-source, time tagging of events.
- Open interface to HMI via Advant OPC Server for Advant Fieldbus 100.
- Support of local and central HMI for manual control operations, event and alarm handling, trend curve presentation etc.
- Support of PROFIBUS-DP with up to 6 segments.
- Support of redundant Fieldbus Communication with Advant Fieldbus 100.

4.4 Advant Controller 110

Advant Controller 110 is a high performance modular controller for logic and regulatory control for midsize applications. It is offering a full complement of control and communication functions and it is designed to suit a wide range of industrial applications, from small to medium-size, from logic to loops, either stand-alone or as an integrated part of an Advant OCS system as well as in any other distributed control system.

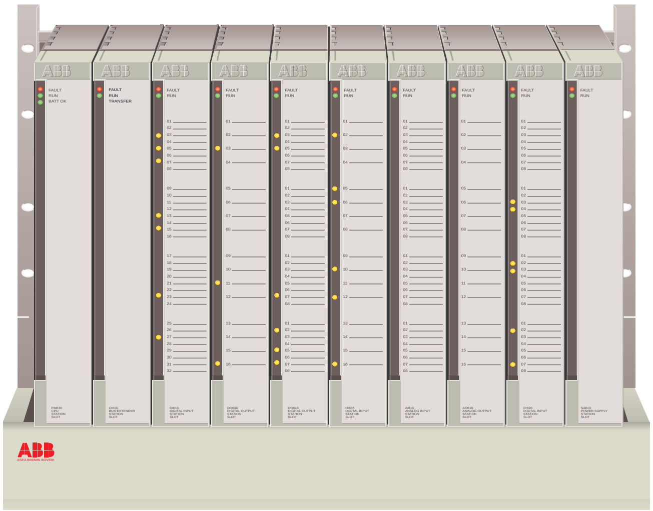


Figure 4-4. Advant Controller 110 with S600 I/O mounted in a subrack

Product Benefits

Advant Controller 110 is specifically designed for high-speed PLC-type applications, but brings also considerable problem-solving power to all analog signal handling and arithmetic applications. It is perfect to live and grow with, thanks to its multitude of expansion possibilities and its on-line programming capability. Advant Controller 110 also includes handling of analog signals for loop control, binary and arithmetical application and it is designed to operate in demanding industrial environments at low cost.

Features

Advant Controller 110 covers a wide range of features such as:

- Rack-based and distributed I/O with a recommended maximum capacity of some 1,500 I/O points.
- Logic and sequence control; arithmetic, pulse counting and regulatory control.
- Hot replacement of all modules.
- True sequential event recording thanks to accurate at-the-source, time tagging of events.
- Open interface to HMI via Advant OPC Server for Advant Fieldbus 100.
- Support of local and central HMI for manual control operations, event and alarm handling,

trend curve presentation etc.

- Support of PROFIBUS-DP.
- Support of RCOM/RCOM+, Siemens 3964R and MODBUS I via built-in RS 232 interface.
- Support of Advant Fieldbus 100 with cable redundancy.
- Configurable directly connected or remotely via RCOM or Advant Fieldbus 100.

4.5 Advant Controller 70

Advant Controller 70 is a small, low cost, modular controller for logic and regulatory control. It is designed according to the latest market requirements in size and flexibility and to suit a wide range of small applications. Advant Controller 70 can be used either stand-alone or as an integrated part of an Advant OCS system as well as in any other distributed control system.

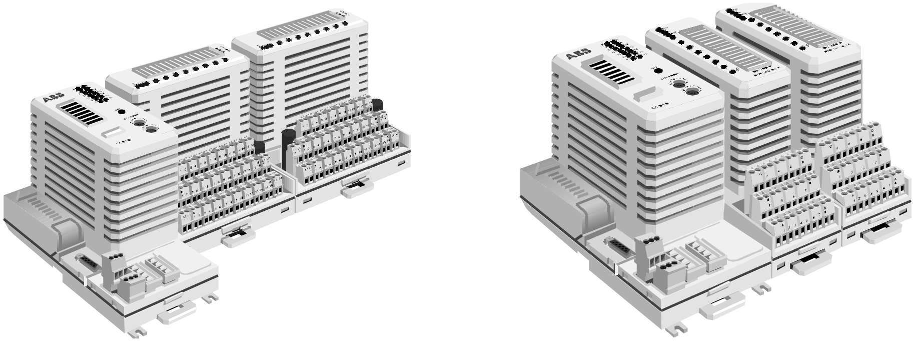


Figure 4-5. Advant Controller 70 processor unit and two I/O modules mounted on an extended or compact termination unit (MTU)

Product Benefits

Advant Controller 70 is specifically designed for small PLC-type applications, but brings also considerable problem-solving power to analog signal handling and arithmetic applications. It is fully modular, with I/O modules plugged in Module Termination Units. Advant Controller 70 is perfect to live and grow with, thanks to its multitude of expansion possibilities and its on-line programming capability. Designed to operate in demanding industrial environments it improves productivity, increases competitiveness and obtains peace of mind.

Features

Advant Controller 70 covers a wide range of functions such as:

- Logic, sequence and PID control; arithmetic and regulatory control.
- Configurable directly connected or via Advant Fieldbus 100.
- Support of easy integration with Drives Units, for example, ACS 600.
- Sequential event recording by accurate at-the-source, time tagging of events.
- Support of the whole scope of supply of S800 I/O modules, with a maximum capacity of 384 digital and 192 analog I/O points.
- Open interface to HMI via Advant OPC Server for Advant Fieldbus 100.
- Support of local and central HMI for manual control operations, event and alarm handling, trend curve presentation etc.
- Built-in RS 232 interface for MODBUS I.
- Support of Advant Fieldbus 100 with cable length up to 12,900 meter (14,100 yards).

4.6 Advant Controller 55

Advant Controller 55 is a small, low cost, compact and configurable controller for binary or analog control, used either as a Programmable Controller (PLC) or Remote Terminal Unit (RTU). It can thereby be used either stand-alone or as an integrated part of an Advant OCS system as well as in any other distributed control system.

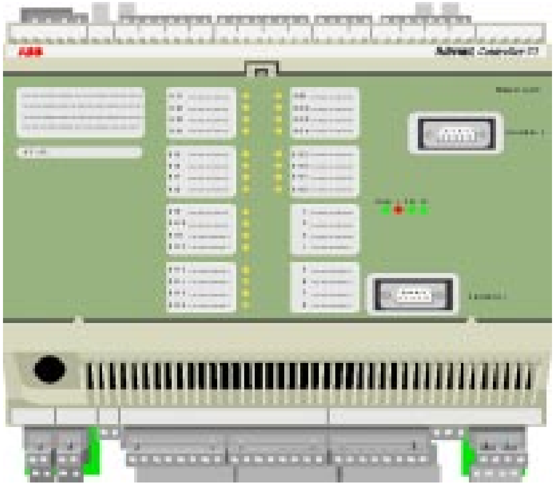


Figure 4-6. Advant Controller 55 Basic Unit

Product Benefits

Advant Controller 55 is specifically designed for small control applications or remote terminal applications. It also includes handling of analog signals for loop control, binary and arithmetical application. Advant Controller 55 is designed to operate in industrial environments as a compact peripheral station.

Features

Advant Controller 55 covers a wide range of functions such as:

- Logic and sequence control.
- Analog data handling.
- Arithmetic and regulatory control.
- Build in I/O, with a maximum capacity of 120 digital and 50 analog I/O points.
- Communication via RCOM/RCOM+.
- Configurable directly connected or remotely via RCOM/RCOM+.

4.7 AdvaControl Loop Tuner

AdvaControl Loop Tuner is the ultimate tool for creating and maintaining high quality plant process control systems. The product incorporates powerful model identification and tuning capabilities and automatic Plant Loop Auditing, providing functionality for the most demanding user.

One of the unique features of the product is the ability to carry out PID tuning whilst maintaining closed loop control, without the need to interfere with plant production. The application can support loop structures ranging from conventional feedback to complex multivariable (MIMO) strategies. Included is a fully-featured real-time feedback loop simulator, ideal for use as a training tool.

The integrated Plant Loop Auditing facility is an on-line quality control system for the plant loops. It automatically monitors loop performance and provides early detection of the onset of problems. This provides the means to optimize the loop performance and manage the maintenance of the valve, sensor and controller efficiently.

AdvaControl Loop Tuner combines professional tuning capabilities with powerful features for plant loop quality control and documentation.

Feature and Benefits

- Plant Loop Auditing

  The Plant Loop Auditing Scheduler allows plant auditing sessions to be automatically scheduled at a user-specified frequency.

- On-Line Plant Loop Tuning

  AdvaControl Loop Tuner allows PID tuning to be carried out in various ways, allowing flexibility with minimum impact on production.

- Plant Simulation

  The AdvaControl Loop Tuner Plant Loop Simulator provides a range of simulation features.

- Plant Loop Identification

  The Plant Loop Identification functionality in AdvaControl Loop Tuner provides a set of fully integrated and powerful utilities, handled by the Supervisory Identification Governor, SIG.

- Controller Design

  Once the SIG has obtained a suitable plant model, the Controller Design part of AdvaControl Loop Tuner automatically calculates the optimum PI and PID settings.

- Loop Historian

  Loop Historian is an integrated documentation facility within AdvaControl Loop Tuner. Each individual loop has a separate Loop Historian text file.

- Data Acquisition

  Data acquisition from the OCS/DCS instrumentation system can be achieved using the following techniques:

  - DDE (Dynamic Data Exchange)
  - Excom (for Advant Master systems) and printer emulation.

- Statistical Process Control

  The Statistical Process Control (SPC) feature of AdvaControl Loop Tuner provides a variety of methods to further evaluate the process data.

- Intelligent User Interface

  AdvaControl Loop Tuner includes an extensive on-line help facility.

- Plant Loop DDE Server

  The Plant Loop DDE Server functions as a stand-alone loop simulator integrated into a DDE Server program.

Chapter 5 I/O Systems

There are three different I/O systems in Advant OCS:

- S800 I/O
- S100 I/O
- S600 I/O.

They are optimized for different use, depending on the type of controller.

5.1 S800 I/O

S800 I/O is a distributed and eco-efficient designed process I/O system for Advant Controller 100 Series and Advant Controller 400 Series process controllers of Advant OCS.

The S800 I/O is a highly modularized and flexible I/O-system, providing easy installation of the I/O modules, process cabling and connection to drives systems. The S800 I/O modules and termination units can be mounted and combined in many different configurations to fit your space requirements and suit many types of applications.

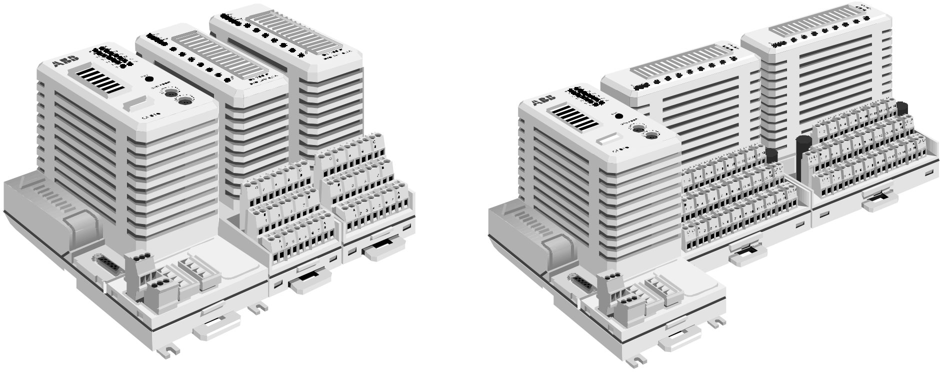


Figure 5-1. S800 I/O. Field Communication Interface with I/O-modules on Compact (left) or Extended (right) Module Termination Units (MTUs)

Product Benefits

- Flexibility, permitting a virtually infinity number of installation arrangements, small to large, indoors or outdoors, wall mounting or floor standing
- Modularity, permitting step-by-step expansion
- Cost-effectiveness, making you save on hardware, cabling, installation and maintenance
- Reliability and auto-diagnostics
- Saves panel cost

- On-board processing capabilities such as time-tagging, event handling, filtering and gain control
- Reduces down time
- Easy to configure.

Features

- Communicates over Advant Fieldbus 100 or Profibus DP
- Quick faultfinding with help of LEDs of each module and channel
- An extensive scope of Digital input/output modules and Analog input/output modules
- Mounted on standard DIN rails
- Support of dual redundancy in power supply
- Support of fieldbus media supervision, bumbles change-over and failure reporting
- All outputs can be individually set to freeze or to take on predefined values.
- Easy connection to drives systems, minimizing communication delays and cost.
- All modules have plastic injection molded enclosures which provide safety protection degree IP20 according to IEC 529.
- I/O modules are protected from destruction by a mechanical keying arrangement if an attempt is made to insert a module type in a position with a different key code than the factory set code of the I/O module. MTUs have keys which are set to key code of its I/O module’s key code.
- An electrical ID is checked at start-up, if this does not match the configured type, the I/O module is not taken into operation.
- Hot-swap of I/O modules allowing replacement of faulty modules without disconnecting field power or system power to the I/O-station.
- I/O modules allow for 55^oC ambient temperature except for vertical mounted Compact MTU with I/O modules allow for 40^oC ambient temperature.
- Support of redundancy Advant Fieldbus 100 media.
- Support of redundancy Advant Fieldbus 100 interface units.
- I/O modules with Ex interface and HART communication

5.2 S100 I/O

S100 I/O is a board-based I/O system where the boards are placed in subracks. It is used together with the Advant Controller 400 Series process controllers.
The range of process I/O modules is complete, consisting of general purpose digital and analog inputs and outputs and special interfaces for special tasks.

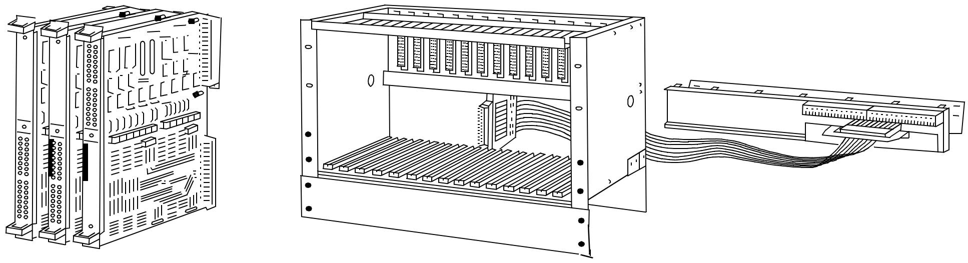


Figure 5-2. S100 I/O Subrack configuration

Benefits

The S100 I/O gives the following benefits:

- a complete set of process interface
- hot replacement of all I/O modules
- high disturbance immunity, meeting the requirements of the EC directives 89/336/EEC and 73/23/EEC when placed in cabinets.
- comprehensive self-diagnostics
- on-board processing capabilities such as time-tagging, event handling, filtering and gain control.
- supports transparent dual redundancy
- modularity, permitting step-by-step expansion
- reliability and auto-diagnostics
- easy to configure.

By using the Object Oriented Connection Units you will reduce the complexity and cost of process control cabling. Object Oriented Connection Units means, besides that they are user friendly, less need for cable marshalling, which leads to easier and faster:

- engineering
- pre-delivery testing
- cable termination
- functional checking
- fault tracing
- system expansion.

Features

The S100 I/O gives you the following features:

- quick faultfinding with help of LEDs of each module and channel
- an extensive scope of Digital input/output modules and Analog input/output modules
- support of dual redundancy in power supply
- all outputs can be individually set to freeze or to take on predefined values
- pulse counting
- frequency measuring
- positioning
- electronic weighing
- speed control of motors

Object Oriented Connection Units:

- indication of signal status at the point of cable termination
- mounted on standard DIN rails
- availability of test plugs.

Both digital and analog Object Oriented Connection Units (OOCU) are available with the vision:

- one device,
- one cable,
- one termination point.

5.3 S600 I/O

S600 I/O is a module based I/O system, used together with Advant Controller 110. The I/O modules are placed in I/O subracks. The process cables are connected via front connectors to the I/O modules.

Chapter 6 Electrical Control

6.1 Drives Integration

ABB standard (pre-programmed from feeder factory) and engineered drives (software adapted for specific needs) can be connected to the Advant OCS in several different ways. The following drives are considered to be standard drives:

- ACS 600 with standard application (SingleDrive ACS)
- ACS 600 Programmable drive which is configured to respond as a standard drive
- ACS 600 MotionControl (ACP)
- ACS 600 Pump&FanDrive (ACF)
- ACS 600 CraneDrive (ACC) which is configured to respond as a standard drive

The following drives are considered to be engineered drives:

- ACS 600 with system application (MultiDrive ACA)
- ACS 600 Programmable drive which is configured to respond as an engineered drive
- DCS 600 MultiDrive using AMC-DC board
- DCS 500B using CON2 board
- ACS 600 CraneDrive (ACC) which is configured to respond as an engineered drive.

Product Benefits

By integrating drives to Advant OCS, full advantage can be taken to added functions. Process data are measured with improved accuracy for even more exact process control, while the ready made information permits a total overview of the drives in a process.

Features

The drive integration encompasses features such as:

- Fieldbus solutions which results in lower wiring costs.
- Optical transmission between a Fieldbus Communication Interface (FCI) and a drive unit allows installations in an electrical disturbed environment.
- Faults in drive available as alarms and in diagnostic displays reduces trouble shooting and maintenance costs.
- Warnings from drive available as events and in diagnostic displays allows the operator to determine when preventive service is needed.
- Predefined type circuit solutions reduces project engineering and commissioning.

For small systems built on Advant Controller 70, the connection is made directly to the drive system through an optical ring or a star by using a Distributed Branching Unit. An important aspect is the simplicity in the connection. No extra hardware is needed in any of the devices, the functions are included in the basic products, minimizing communication delays and cost.

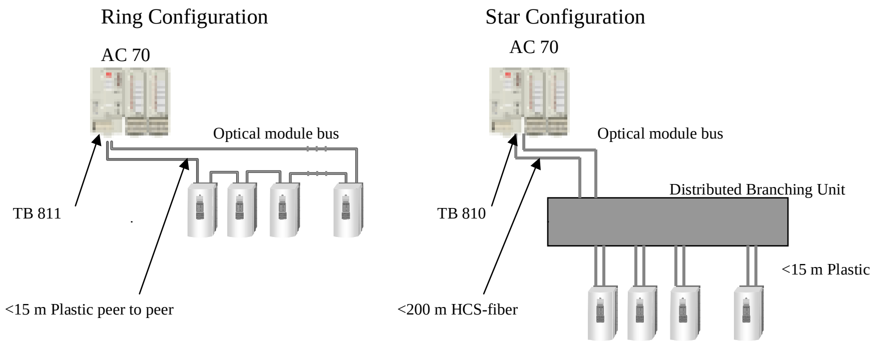


Figure 6-1. AC 70 configuration with drives

For large control systems, built on Advant Controller 410/450, the connection to standard or engineered drives are made via Advant Fieldbus 100. Each fieldbus node connects the drives in a ring or in a star configuration by using a Distributed Branching Unit.

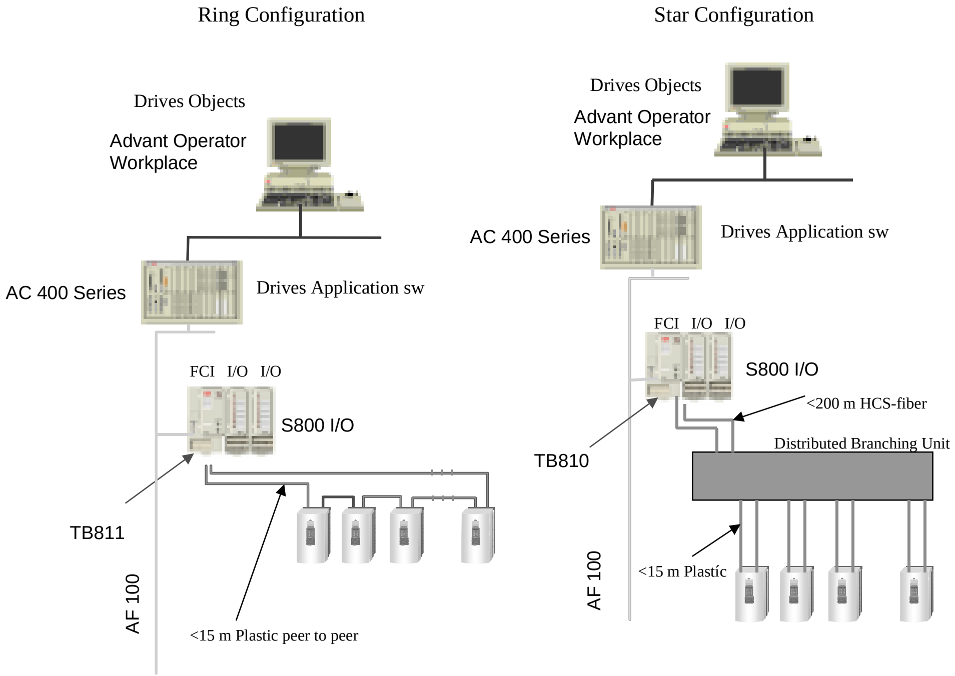


Figure 6-2. AC 400 Configuration with drives

Information from the drives:

> Values are sent as cyclic data, with an updating frequency decided by the application engineer. The data enables the control system to have access to basic information such as speed, current, torque and diagnostic information.

Information from the controller:

> A setpoint for speed or torque in percentage or absolute values can be sent. It is also possible to give commands to the drive, for example, start, stop and fault reset.

The operator support in AdvaCommand includes a number of drive specific displays and dialogs as well as the possibility to use functions such as system status, alarm and event handling and trend curves.

In order to minimize engineering efforts, a predefined type circuit is offered. It consists of control logic for a drive in a system with Advant Controller 410/450.

Chapter 7 Communication

Advant OCS provides a variety of communication solutions for individual requirements. We present the communication in two different categories:

- MasterNet communication
- Fieldbus communication.

MasterNet communication is used for connecting nodes on control network and plant network. Fieldbuses are used for interconnecting field devices, local Human Machine Interface (HMI) panels, local engineering tools, very small controllers and I/O with the Advant controllers. Figure 1-1 gives an overview of the Advant communication structure.

Advant OCS supports the interface between different communication media/protocols and other data link related equipment, such as modems, transceivers, etc.

For communication with external systems, Advant OCS offers different types of communication stations, interfaces and protocols:

- Multi-Vendor Interface includes communication modules for direct connection of third party control equipment to Advant Controller 400 Series and Advant Controller 110.
- EXCOM is an easy-to-use communication protocol which provides external computers access to data in Advant Controller 400 Series. It is easy to implement and provides an efficient, low-cost link to Advant OCS.
- TCP/IP is used for communication with an Oracle data base via SQL*Net, X protocol communication, and special printers.
- GCOM is an Ethernet based protocol used for communication with external computers. GCOM can also be used in the MasterGate 230/1 communication station, to connect external computers to MasterNet.

Using standards such as DDE, SQL and X Window System also provides excellent communication capabilities with external systems. AdvaInform SQL*Connect contributes with particularly powerful utilities for information integration, by offering external systems controlled access to the real-time data base of Advant OCS through standard SQL calls and vice versa, just as if the data was part of the local data base.

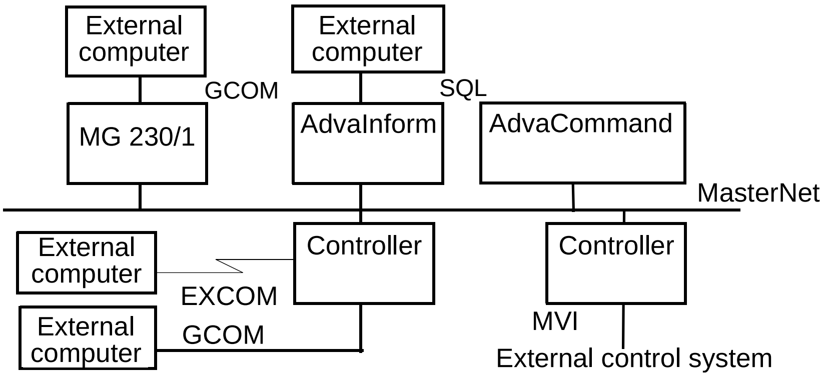


Figure 7-1. Integration with other systems

7.1 MasterNet Communication

Within the frame of MasterNet are:

- Control Network
- Plant Network.

MasterNet is built with bus type data links. There are different bus alternatives for different requirements; for high performance in large systems or in systems with high demands on data communication, and for cost effective solutions in smaller systems, and also for extending the communication distance by using Bridges. The bus alternatives use the same user application interface, and can replace each other without effects on application programs, if the resulting configuration follows the MasterNet configuration rules. All buses can have redundant data links. The redundant communication is transparent to the application programs. Data links:

- MasterBus 300, a high performance medium distance data link for large systems and for large communication capacity requirements. It uses the IEEE 802.3 CSMA/CD (Carrier Sense Multiple Access/Collision Detection) medium access control protocol.
- MasterBus 300E (Extended) - used when communicating via Bridges and to interconnect MasterBus 300 networks. MasterBus 300E uses the IEEE 802.3 CSMA/CD medium access control protocol and the communication parameters can be tuned.
- GCOM, a high performance medium distance data link to connect Advant OCS to plant networks and external computers. It uses the IEEE 802.3 CSMA/CD control protocol.

Table 7-1. Maximum number of buses per node.

Type	MB 300/300E	GCOM
Advant Controller 410	2	2
Advant Controller 450	6	2
MasterGate 230/1	4	2
Advant Workplace	2	-

Requirements

All communication equipment used, such as cables, transceivers, repeaters, bridges, etc. must comply with the IEEE 802.3 - 1985 (ISO 8802-3) standard. Selecting communication equipment may be the key factor that determines the availability and Mean Time between Failure (MTBF) of the whole installation. In order to increase your productivity, use only equipment and suppliers that have a record of good performance.

Features

MasterNet covers a wide range of functions such as:

- self configuring
- redundancy
- transport connections with different priorities
- remote engineering support
- clock synchronization.

7.1.1 Control Network

Outline Description

The control network is used to interconnect the various stations in an Advant OCS automation system. It effectively isolates communication functions from the rest of the system, and thus

gives complete freedom to extend or restructure the network with limited effects on application programs.

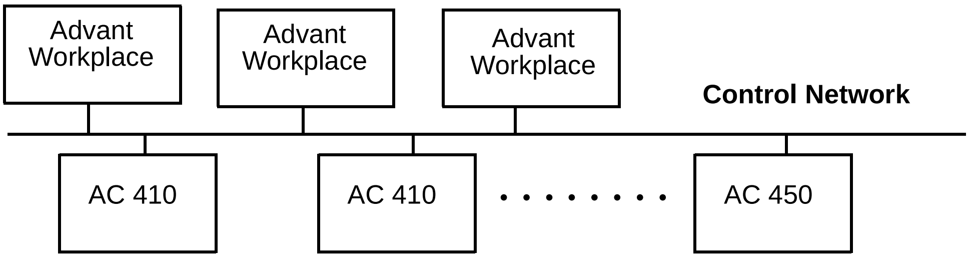


Figure 7-2. An Advant OCS control network

A MasterNet network is “self configuring”, which means that it requires no descriptions of the network topology. Instead, MasterNet finds out the network configuration by itself, and automatically adapts to changes. New stations are included in the communication system as soon as they are connected to the network and started.

Between Advant Workplace, MasterGate 230/1 and Advant Controller 400 Series, information is exchanged by means of predefined messages for display updates, manual orders, events and alarms, etc. This information exchange is fully automatic and never needs to be a concern of the user.

The information exchange between separate Advant Controllers is by means of “Data Sets”; messages containing aggregates of data base information. Data Sets are explicitly specified in the communicating Advant Controllers, as part of the application configuration.

The communication between an Advant Controller and an Advant Workplace takes place by object information exchange.

The data link on the control network is not to be shared by other IEEE 802.3 based protocols. The GCOM protocol is allowed, but then only when used for communication with other Advant OCS products; Advant Station 100 Series IMS and external computers towards Advant Controller 400 Series.

The reason why external computer systems must not be connected to the same physical bus as the control networks is that the system performance is reduced, both for the Advant OCS system and for the external computer systems.

Performance

The transmission rate is 10 Mbits/second. This gives an effective data transfer rate of approximately 2000 packets/second. The length of each packet is up to 300 bytes. This capacity is sufficient for an Advant OCS control network.

The performance depends on the delays and bandwidth limitations caused by the Bridges. In MasterNet User´s Manual there are some formulas for calculating the required bandwidth in-between the bridges depending on the communication load.

A Control Network can consist of up to 9 buses.

A Control Network consisting of MasterBus 300/300E can contain up to 45 nodes.

7.1.1.1 MasterGate 230/1

MasterGate 230/1 is used to link external computers to MasterNet and to interconnect separate control networks into a plant network. It offers high performance communication and is therefore suitable for connecting larger computer systems for management information, production planning and optimization, etc.

MasterGate 230/1 acts as a gateway between MasterNet and communication links to external computers. It transfers messages between the networks transparently. The external computer can use the full functionality employed in the data exchange within Advant OCS, and is actually regarded as a full member of the MasterNet Network.

Features

When used to interconnect control networks into a plant network, MasterGate 230/1 makes information exchange between the networks possible. Still, a logical separation of the networks is maintained.

MasterGate 230/1 has the following main functions:

- interconnect separate MasterNet control networks
- connect plant network level stations to control networks
- connect external computers to Advant OCS automation system through GCOM
- data flow control. Used to supervise and control data traffic load towards the own control network and resource allocation in the own control network by nodes on the plant network.
- authority control towards the own control network. Separate authority control is performed for control network - control network and for plant network - control network communication.
- the clock synchronization in the MasterGate 230/1 can be set to distribute clock synchronization within the own control network or plant wide to all external computers and control networks.
- MasterGate 230/1 also contains a symbolic name translator function, which distributes symbolic name requests to/from own control network.

The following applies for communication through MasterGate 230/1:

- Plant network - Control network
  - All data subscription types and Commands are allowed
  - Data Set and Text Set communication are allowed
  - Max four nodes or HMI's on plant network can subscribe for cyclic data from one control network
  - Symbolic name translation from control network to plant network is default blocked. (Selectable function)
  - Alarms and events are not distributed from control network to plant network.
- Control network - Control network
  - Only data subscription of type "demand" is allowed.
  - Commands are not allowed
  - Data Set and Text Set communication are allowed
  - Symbolic name translation from control network to control network is by default blocked. (Selectable function)

Performance

Up to 50 messages per second, with a maximum message length of 512 bytes is possible. Examples of messages are subscription signals, data sets, and orders.

7.1.1.2 EXCOM

Outline Description

EXCOM is a protocol, by which an external computer can access data in the Advant Controller 400 Series process data base. It is a ASCII request/reply protocol, suited to small volume data exchange requirements. The external computer can read and write data in the Advant Controller 400 Series process data base, using simple commands and a low-cost asynchronous RS-232C communication link. You can implement the protocol in any computer, using basic input/output facilities. EXCOM support has already been developed for a number of different computers. EXCOM has the following characteristics:

- Routing is supported, which means that access to all Advant Controller 400 Series Controllers connected to a control network is provided via a single EXCOM link, that can reside in any of the controllers connected to the network.
- Records in the data base files and dataset definitions are identified by symbolic names which are translated to records respectively dataset numbers with a translation command.
- All communication is by 7-bit ASCII code. Numerical values are in ASCII coded decimal representation.
- Flow control is by XON/XOFF.
- Electrical interface is RS-232C. The transmission mode is asynchronous and full duplex.

- The communication mode is a fixed master/slave relationship, where the external computer is the master. Protocol elements are requests from the external computer and responses from Advant OCS.

Data references are always to the Advant Controller 400 Series process data base, but the physical connection can be via MasterNet and another controller in the Advant Controller 400 Series or MasterGate 230/1. All of these products offer EXCOM connections as options.

Network Configurations

For distances up to 15 m (49 ft.) EXCOM can be used without modems, assuming that it can be guaranteed that the CMV will stay below ± 7 V at all times. With modems (for example, DSTC X008) the distance between the modems can be up to 1000 m (3280 ft.) at 19.2 kbit/s.

Performance

EXCOM operates at a speed up to 19.2 kbit/s. The communication speed and data throughput depends on the controller, the physical media, and the external computer.

7.1.1.3 GCOM

GCOM is an Ethernet based protocol used for communication with external computers. GCOM can also be used in the MasterGate 230/1 communication station, to connect external computers to MasterNet.

Standards

Using standards such as DDE, SQL and X Window System also provides excellent communication capabilities with external systems. AdvaInform SQL*Connect contributes with particularly powerful utilities for information integration, by offering external systems controlled access to the real-time data base of Advant OCS through standard SQL calls and vice versa, just as if the data was part of the local data base.

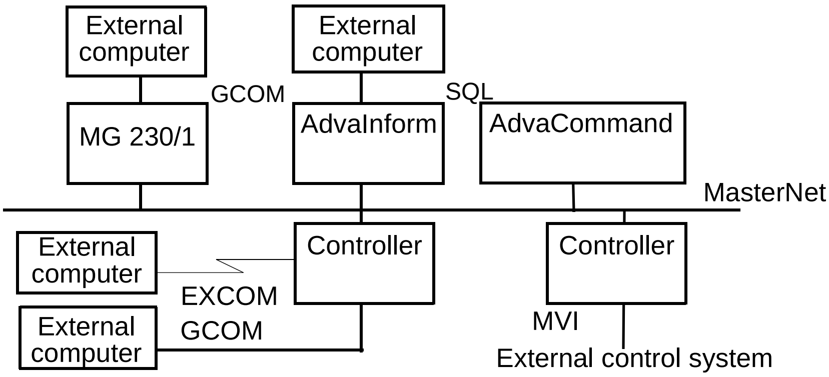


Figure 7-3. Integration with other systems

7.1.2 Plant Network

Outline Description

Plant network is used to interconnect separate control networks, connect plant-wide operator Advant Workplaces (MB 300/300E or GCOM) and external computers to Advant OCS. The plant network is suitable for connecting larger computer systems for management information, production planning and optimization, etc.

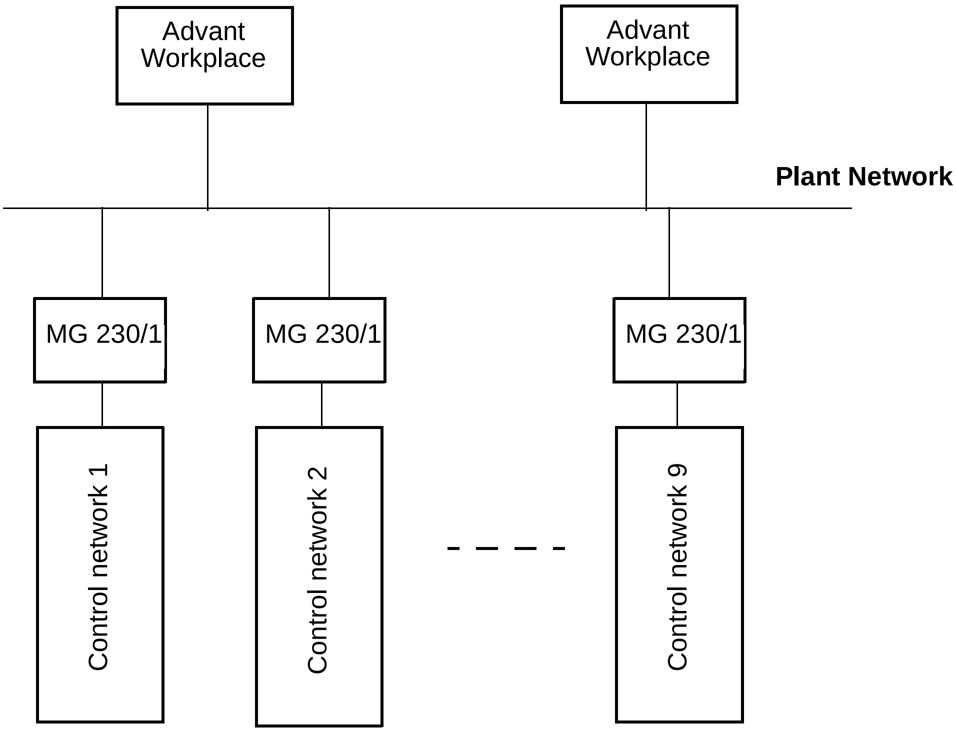


Figure 7-4. MasterNet plant network

The plant network can be built with the following protocols:

- MasterBus 300/300E - between several MasterGate 230/1 and between Advant Workplace and MasterGate 230/1
- GCOM (IEEE 802.3) - between Advant Station 100 Series IMS and MasterGate 230/1 and between external computers and MasterGate 230/1
- TCP/IP - between Advant Workplace, for X terminals, SQL requests, and file transfer.

The data link on the plant network can be shared between MasterBus 300/300E, GCOM, and TCP/IP. Protocols from other vendors are allowed. These can normally share the same cable, but you can have several cables for different protocols.

Performance

A Plant Network consists of one bus (plus one optional redundant bus).

Up to nine MasterGate 230/1 can be connected to a plant network, interconnecting up to nine control networks.

Maximum four nodes on the plant network can concurrently have cyclic or event driven data subscriptions from a control network.

7.1.2.1 TCP/IP Protocol

Outline Description

For interconnection of Advant Workplaces as well as communication with external computers, services on top of the Transmission Control Protocol/Internet (TCP/IP) protocol are used for tasks such as display transfer, X window access, data base networking using SQL*Net, and file back up.

The Transmission Control Protocol (TCP) is based on the DARPA standard. TCP provides non-duplicated, in-sequence data delivery.

TCP is a connection-based protocol and requires more initial overhead than a datagram-based protocol. TCP also provides flow control. The amount of data sent can be controlled so that the sender does not overload the receiver.

The Network layer in the OSI model implements the Internet Protocol (IP) based on the DARPA standard. IP is a connectionless delivery mechanism for internetwork packet routing. It defines an internet addressing scheme which can uniquely identify multiple networks as well as a node within a single network.

At the Physical and Data Link Layers the IEEE 802.3/Ethernet Driver is used. In order to access other TCP/IP networks, standard IEEE 802.3 communication bridges or routers can be used, thus allowing for wide-area networks (WAN).

The services that run via TCP/IP are file transfer protocol (ftp), telnet, remote copy (rcp), remote login (rlogin) and remote shell (remsh).

For extension of the local network by using repeaters and TCP/IP addressing, etc. please refer to the TCP/IP section in the Hardware section.

Depending on EMI levels and maximum length on the bus, 10base5 or 10base2 can be selected.

Network Configurations

Maximum number of connections are 100 for 10base^{5} and 30 for 10base^{2}.

Performance

The communication speed and total throughput depends on the computers concerned, the data exchange on the network and the communication net itself.

7.2 Fieldbus Communication

Fieldbuses are used to connect peripheral units to, for example, Advant Controllers. Several different fieldbuses with different capabilities are supported by Advant OCS:

- Advant Fieldbus 100
- PROFIBUS-DP
- MasterFieldbus
- LONWORKS Network.

The Multi Vendor Interface (MVI) concept is used for easy adaptation to different fieldbuses with limited performance requirements. A development support kit exists for development of own protocol interfaces, and a number of interfaces are currently available such as:

- Modbus
- Siemens 3964R
- Allen Bradley DF1.

7.2.1 Advant Fieldbus 100

Outline Description

Advant Fieldbus 100 is a high-performance, high-speed communication link, specifically designed for real time applications. It features reliable, cyclic (deterministic) data transfer (using Data Set Peripherals), at the same time as event-driven background transfer of service data. Advant Fieldbus 100 supports several media types as well as redundancy.

Advant Fieldbus is used to connect different ABB products to Advant Controllers such as S800 I/O, Advant Controller 70, variable speed drives from ABB Drives, etc.

Small control systems can entirely be built up around AF 100 using Advant Controller 70, Advant Controller 110, S800 I/O and AdvaSoft for Windows or the OPC-server for Advant Fieldbus 100 together with any OPC-supported HMI product.

Up to 10 AdvaSoft for Windows, OPC servers and Advant Controller 400 Series can receive alarms and events from one or several Advant Controller 70 or Advant Controller 110.

Any unit on the bus can be removed from the bus and be replaced without disturbing other stations on the bus or their communication with each other. Communication with a reconnected unit is resumed automatically.

Network Configurations

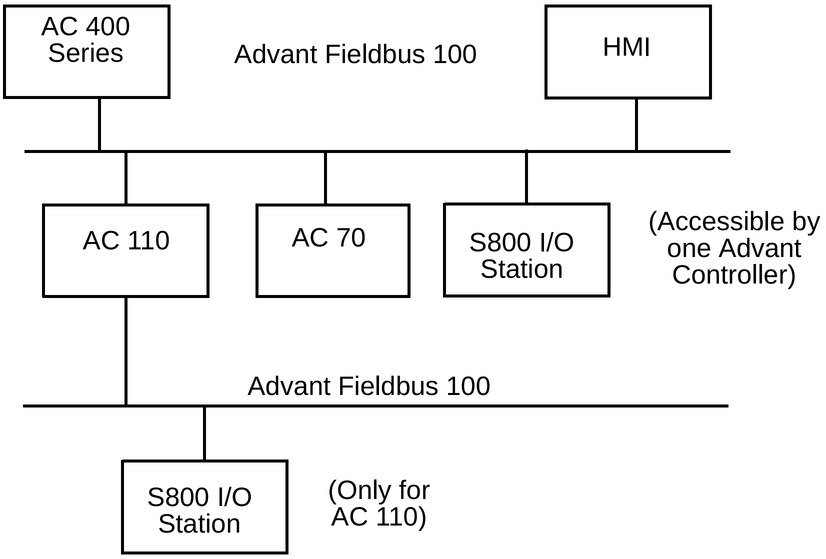


Figure 7-5. An Advant Fieldbus 100 network

Service data transfers allow remote access from an AdvaSoft for Windows, Advant Controller 400 Series, Advant Controller 100 Series to any Advant Controller 100 Series on the bus. With remote access from an Advant Station 130 connected to an Advant Controller 400 Series or Advant Controller 100 Series, it is possible to configure or test any Advant Controller 100 Series connected to the same bus.

On Advant Fieldbus 100, service data is transferred in background mode and is automatically initiated when required. It does not disrupt or delay cyclic data communication.

Up to 80 stations can be connected to one Advant Fieldbus 100.

Bus length, Media and Segments

Advant Fieldbus 100 can be configured for the three buslengths 2000 (6500), 8500 (28600) and 15000 (48700) meters (feet). The actual bus length is depending on the transmission media and number of repeater modems. The achievable bus length is up to 1700, 7600 and 13300 m. Three types of media are supported, depending on cable choice:

- coaxial cable
- twisted pair (twp) cable
- optical fibre.

The bus can be built up by several segments and by this allowing distances longer than 700 meters (2300 ft.) (coaxial) resp. 750 meters (2500 ft.) (twisted pair). For twisted pair media, up to 32 stations can be connected to each segment. Different segments are interconnected with repeater modems which allows change of media type or can serve as galvanic isolation towards an highly disturbant environment.

Available repeater modems:

- twisted pair/twisted pair
- twisted pair/coaxial
- twisted pair/optical
- coaxial/optical.

Redundancy Concept

The redundancy concept is transparent for all application programs, that is, it does not affect the shape of the programs.

Advant Fieldbus 100 redundancy concept comprehends:

- Media redundancy
- Communication interface redundancy
- S800 I/O Fieldbus Communication Interface redundancy

Media Redundancy

An Advant Fieldbus 100, may be installed with one or two physical bus lines (single or redundant media). Two bus lines are chosen when increased availability is required. In configurations with two bus lines, data is always transmitted on both lines, but received on one line only. Switching receiving line is done automatically in case one bus line fails. When redundant lines are used the redundancy must be maintained throughout the whole bus (including all segments). This comprises bus lines as well as connections of nodes to the bus. The redundant bus line does not increase the data through put when both bus cables are operating.

Communication Interface Redundancy

For increased availability redundant communication interfaces can be used in Advant Controller 450 and Advant Controller 160. The redundant communication interfaces are connected to a media redundant bus. The communication interface redundancy is performed with a Primary/Back up relationship between the two communication interfaces. Data is transferred via the Primary while the Back up monitors the Primary, ready to take over in case the Primary fails.

S800 I/O Fieldbus Communication Interface redundancy

Redundancy in the S800 I/O Stations is achieved with redundant S800 I/O Fieldbus Communication Interfaces (FCIs) connected to a media redundant Advant Fieldbus 100. In the S800 I/O station redundancy is performed with redundant S800 communication interfaces sharing the same I/O modules. The redundancy is performed according to the same principles as communication interface redundancy in the Advant Controller 450.

Bus Administration

Advant Fieldbus 100 features a master scheme, distributed to one or several communication interfaces on the bus, such interface is denoted Bus Administrator (BA). One of the Bus Administrators is master, while the others are back ups. The master Bus Administrator controls the traffic on the bus, concerning the master scheme, by polling data to be sent.

The communication module in the controllers supports the exchange of data by cyclic data communication and the message transfer.

Performance

The transmission rate is 1.5 Mbit/second. Cyclic communication is user configured by means of Cyclic Data Packets (CDPs), each corresponding to a Data Set Peripheral. Cyclic data packets are configured to be transferred on the bus with cyclicity of 1, 2, 4, 8,... ,4096 ms and with size of 2, 4, 8, 16, and 32 bytes. Cyclic Data Packets are broadcasted on the bus. Cyclic data transmission can use up to 75% of the total bus capacity. The remaining 25% is reserved for message transfer. Message transfer is used for, for example, event handling or remote access.

Any unit on the bus can be removed from the bus and be replaced without disturbing other stations on the bus or their communication with each other. Communication with a reconnected unit is resumed automatically.

7.2.1.1 Advant Fieldbus 100 Hardware

Advant Fieldbus 100 Cables

The cable types to use are:

- Coaxial cable, up to 300 m (1000 ft.) per segment
  - RG59 B/U, 75Ω, Connectors: BNC
- Coaxial cable, up to 700 m (2300 ft.) per segment
  - RG11 A/U, 75Ω, Connectors: BNC
- Twisted pair cable, up to 750 m (2500 ft.) per segment,

  Communication media according to IEC 1158-2 fieldbus standard. Example of twisted pair cable used:

  - Trunk cable:
    Belden - 9182 (Commercial),1 pair, Stranded conductors,
    Belden - 89182 (Plenum),1 pair, Stranded conductors,
    IBM type 1, 2 pair, Solid conductor,
    IBM type 1A, 2 pair, Solid conductor.
  - Tap cable:
    Intercond - DK24-02U, 2*2*24AWG
    Belden - 1215A, 2 pair, Stranded conductors (electrically IBM Type 6A),
    IBM Type 6, 2 pair stranded conductors,
    IBM Type 6A, 2 pair stranded conductors
  - Connectors: For example, Phoenix Combicon MSTB 2.5/4-ST-5,08

- Optical fibre allows the total bus length to be, up to 1700 m (5500 ft.). Dual 62.5/125 µm Multimode graded index type, Connectors: Multimode ST Style

Coaxial cables are mounted using drop cables, with BNC T-adaptor, which are connected to the AF 100 modem. Twisted pair cables are mounted using tap cables, with connection unit TC505 or TC506 (for capacitive decoupling outside cabinets), which are connected to the AF 100 modem. By using drop resp. tap cables exchanging a faulty communication interface without interrupting the communication on the bus is possible.

Advant Fieldbus 100 length concept

Advant Fieldbus can be configured for three logical bus lengths:

- 2000 m (6500 ft.) allowing a physical bus length of up to 1700 m (5500 ft.).
- 8500 m (28600 ft.) allowing a physical bus length of up to 7600 m (24700 ft.).
- 15000 m (48700 ft.) allowing a physical bus length of up to 13300 m (43200 ft.).

The length between the two outermost ends of the total bus is calculated according to the following formula:

$$\text{Lcoax} + \text{Ltwp} + \text{Lopto} + \text{M} * 150\ (500\ \text{ft.}) \leq 2000 \text{ or } \leq 8500 \text{ or } \leq 15000$$

where
2000 = The bus length budget is 2000 meters (6500 ft.).
8500 = The bus length budget is 8500 meters (28600 ft.).
15000 = The bus length budget is 15000 meters (48700 ft.).
Lcoax = Total length of coaxial media.
Ltwp = Total length of twisted pair media.
Lopto = Total length of optical media.
M = Number of TC513V1, TC514V2, TC515V2 and TC630 modems on the bus between the two outermost ends.

Due to delays in the modem circuits, each TC513V1, TC514V2, TC515V2 and TC630 corresponds to 150 meters (500 ft.) of the total bus length.

Table 7-2. Communication Interfaces available for bus cable lengths 8500 meters and 15000 meters

Station type	Comm. Interf.	Base system
Advant Controller 410	CI522A	AC 410 *1.5
Advant Controller 450	CI522A	AC 450 *2.3
S800 I/O Station	CI810A	CI810 *1.4
S800 I/O Station (Redundant Field Communication interfaces)	CI820	CI820 *2.1

Communication Interfaces and Modems

A node is connected to the bus with a communication interface and an Advant Fieldbus 100 modem per bus line. The communication interface and modem to use for the different kind of stations and media are shown in Table 7-3. For optical media a pair of modems, TC514V2 or TC630, is always used.

Examples of Advant Fieldbus 100 configurations using coaxial and twisted pair media are illustrated in Figure 7-6 and Figure 7-7.

Table 7-3. Communication interface and modem to use for the different stations and media

Station Type	**Coaxial Media**		**Twisted Pair Media**	
	Com. Interface	**Modem**	**Com. Interface**	**Modem**
S800 I/O Station	Integrated	TC513V1	Integrated	Integrated
AC 70	Integrated	TC513V1	Integrated	Integrated
AC 110	CI626V1	Integrated in CI626V1	CI627	Integrated in CI627
AC 400 Series	CI520V1/CI522A	TC625	CI520V1/CI522A	TC512V1/TC516
AdvaSoft for Windows, OPC Server	CI526V1	TC625	CI526V1	TC512V1/TC516

NOTE

1. For single bus cable connection of the CI626, a special drop cable kit is used.
2. If CI520V1, CI522A, CI526V1, CI626V1, CI627, CI810V1 and/or PM810V1 are used on the bus, media redundancy is fully supported for optical, coaxial as well as for Twisted Pair media.
3. If any CI520, CI526 and/or CI626 is used:
   a. Coaxial media redundancy is supported, with restrictions in cable length difference between the two redundant cables.
   b. With optical bus cable, one physical bus line is possible.

A node is connected to the bus with a communication interface and an Advant Fieldbus 100 modem per bus line. The communication interface and modem to use for the different kind of stations and media are shown in Table 7-3. For optical media a pair of modems, TC514V2 or TC630, is always used.

Examples of Advant Fieldbus 100 configurations using coaxial and twisted pair media are illustrated in Figure 7-6 and Figure 7-7.

Coaxial Media

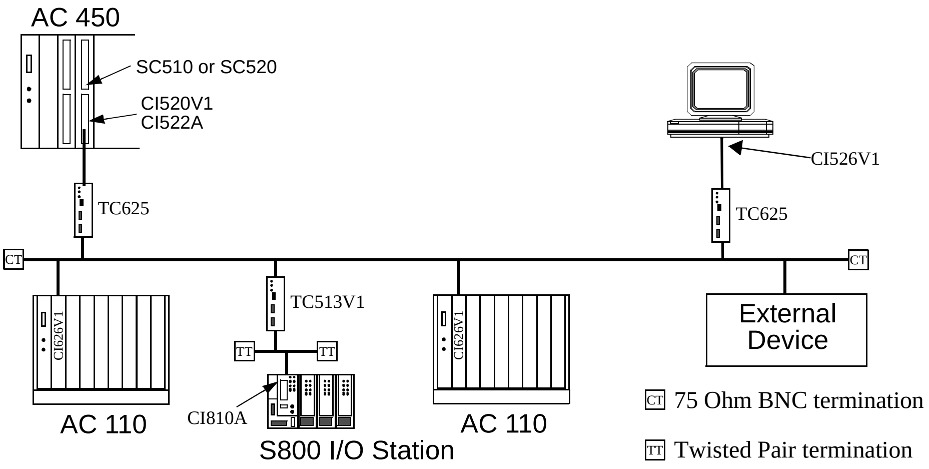


Figure 7-6. Advant Fieldbus 100 configuration using coaxial media

Twisted Pair Media

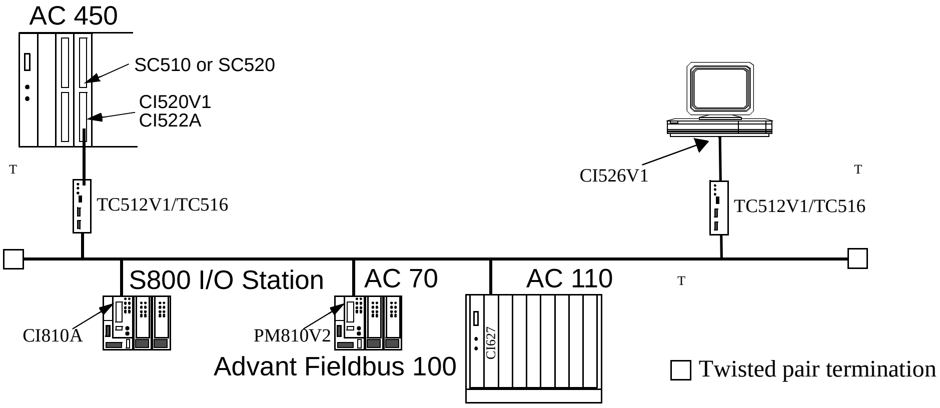


Figure 7-7. Advant Fieldbus 100 configuration using twisted pair media

Up to 32 stations can be connected for each twisted pair cable segment.

Converting Bus Media

An Advant Fieldbus 100 can be built up with several media. Conversion of media is performed with the modems: TC513V1 for coaxial to twisted pair conversion (or twisted pair to coaxial conversion), TC514V2 for coaxial to optical conversion, TC515V2 for twisted pair to twisted pair conversion and TC630 for coaxial to optical conversion. For optical media only point to point connection is supported.

An Advant Fieldbus 100 can be built up with several media. Conversion of media is performed by using the following with the modems:

- TC513V1 for coaxial to twisted pair conversion (or twisted pair to coaxial conversion)
- TC514V2 for coaxial to optical conversion
- TC515V2 for twisted pair to twisted pair conversion
- TC630 for coaxial to optical conversion.

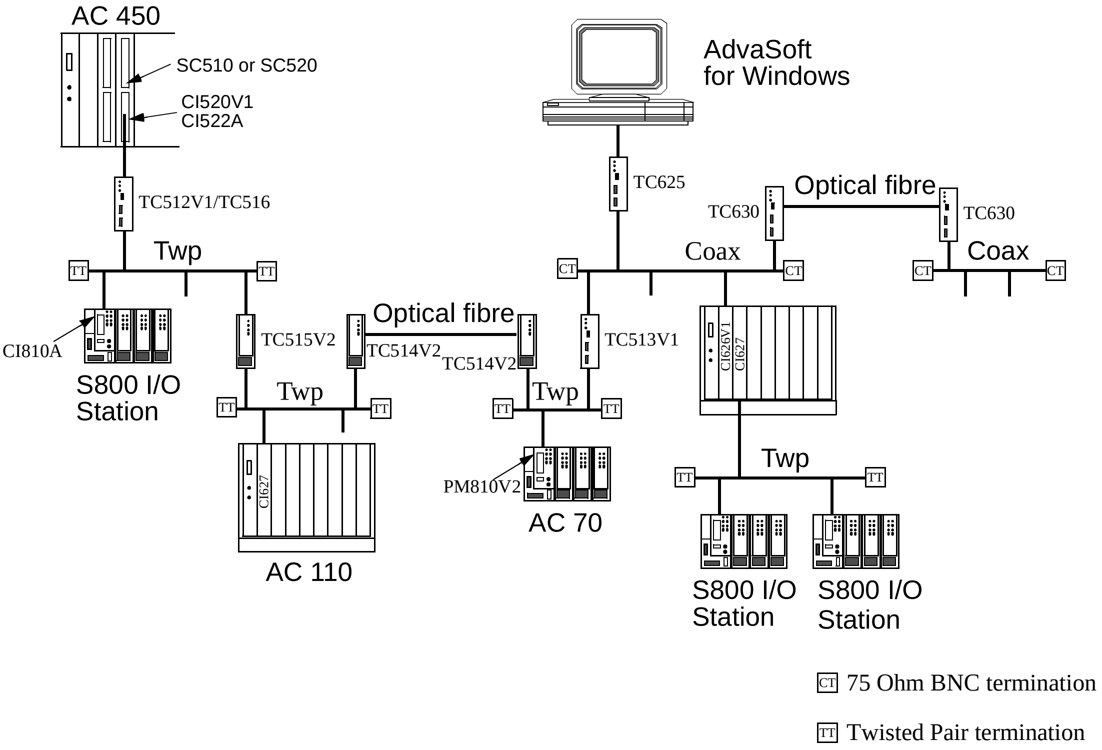


Figure 7-8. Media conversion in Advant Fieldbus 100

The maximum bus length of the configuration illustrated in Figure 7-8 is calculated according to:

Logical bus length 2000 meter:
$(\text{Cable})_{\text{twp}} + (\text{Cable})_{\text{twp}} + (\text{Cable})_{\text{opto}} + (\text{Cable})_{\text{twp}} + (\text{Cable})_{\text{coax}} + (\text{Cable})_{\text{opto}} + (\text{Cable})_{\text{coax}} \leq$
$\leq 2000\text{ m} - (150_{\text{TC515}} + 150_{\text{TC514}} + 150_{\text{TC514}} + 150_{\text{TC513}} + 150_{\text{TC630}} + 150_{\text{TC630}}) =$
$= 1100\text{ m}$ (3600 ft.)

Logical bus length 8500 meter:
$(\text{Cable})_{\text{twp}} + (\text{Cable})_{\text{twp}} + (\text{Cable})_{\text{opto}} + (\text{Cable})_{\text{twp}} + (\text{Cable})_{\text{coax}} + (\text{Cable})_{\text{opto}} + (\text{Cable})_{\text{coax}} =$
$= (3*750_{\text{twp}} + 2*1700_{\text{opto}} + 2*700_{\text{coax}} = 5550$ meter (max. physical cable length).

Physical cable length $+ 150_{\text{TC515}} + 150_{\text{TC514}} + 150_{\text{TC514}} + 150_{\text{TC513}} + 150_{\text{TC630}} + 150_{\text{TC630}} =$
$= 5550_{\text{cable}} + 900_{\text{modems}} = 6450$ meter < 8500 meter.

Logical bus length 15000 meter:
$(\text{Cable})_{\text{twp}} + (\text{Cable})_{\text{twp}} + (\text{Cable})_{\text{opto}} + (\text{Cable})_{\text{twp}} + (\text{Cable})_{\text{coax}} + (\text{Cable})_{\text{opto}} + (\text{Cable})_{\text{coax}} =$
$= (3*750_{\text{twp}} + 2*1700_{\text{opto}} + 2*700_{\text{coax}} = 5550$ meter (max physical cable length)

Physical cable length $+ 150_{\text{TC515}} + 150_{\text{TC514}} + 150_{\text{TC514}} + 150_{\text{TC513}} + 150_{\text{TC630}} + 150_{\text{TC630}} =$
$= 5550_{\text{cable}} + 900_{\text{modems}} = 6450$ meter < 15000 meter.

For logical bus length 2000 meter configuration above the total bus length is limited to 1100 meter spread out on the twisted pair, coaxial and optical cables. For 8500 and 15000 meter configurations the bus can be further extended as the logical budgets are not fully used.

Advant Fieldbus 100 lengths 8500 and 15000 meter

With Advant Fieldbus 100 distances of up to 13300 meters can be reached. This is achieved by interconnecting bus segments by using the modems TC513V1, TC514V2, TC515V2 and TC630.

The maximum segment length are 700 meters for coaxial media, 750 meters for twisted pair media and 1700 meters for optical media.

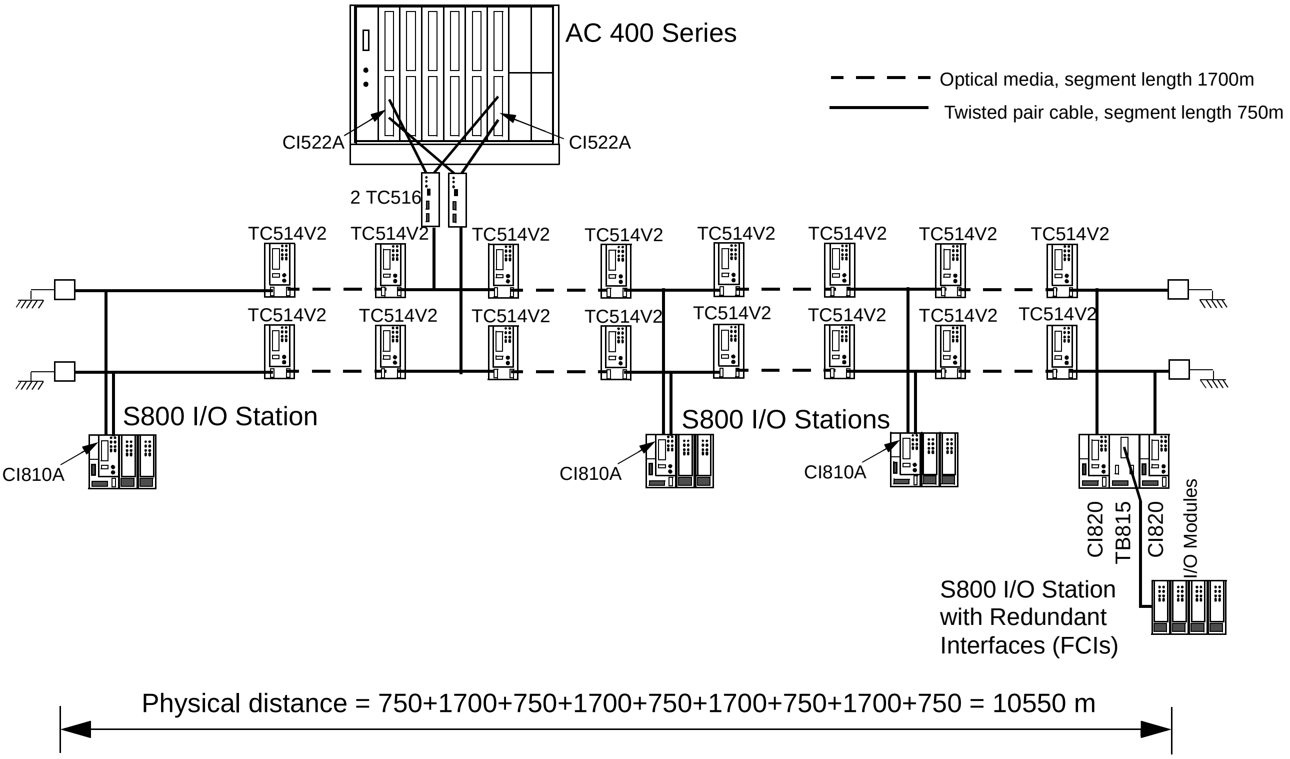

AC 400 Series
Optical media, segment length 1700m
Twisted pair cable, segment length 750m
CI522A
CI522A
2 TC516
TC514V2
S800 I/O Station
S800 I/O Stations
CI810A
CI810A
CI810A
CI820
TB815
CI820
I/O Modules
S800 I/O Station with Redundant Interfaces (FCIs)
Physical distance = 750+1700+750+1700+750+1700+750+1700+750 = 10550 m

Figure 7-9. Advant Fieldbus 100 cable lengths of 8500 and 15000 meter

Media Redundancy

Media redundancy includes redundant cable and redundant modems. A media redundant Advant Fieldbus 100 is built up as in Figure 7-10.

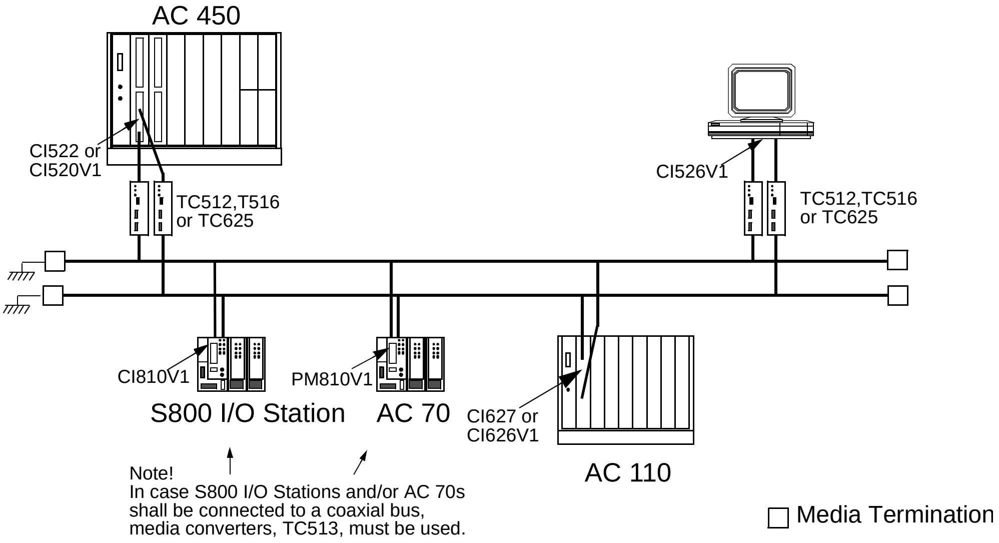


Figure 7-10. An Advant Fieldbus 100 configuration using redundant media

Communication Interface Redundancy

Communication interface redundancy is achieved by using two CI522s connected to a media redundant bus. Communication interface redundancy is available for Advant Controller 450 only. For connection of redundant communication interfaces, CI522s, to a twisted pair bus two TC516 modems are used (alt. four TC512), see Figure 7-11. At connection to a coaxial cable bus four TC625 modems are required. The TC516 modem has two connections one for each redundant CI522 and a connection to one twisted pair bus cable. TC516 can be used for two redundant CI522s as well as for one single CI520V1/CI522/CI526V1.

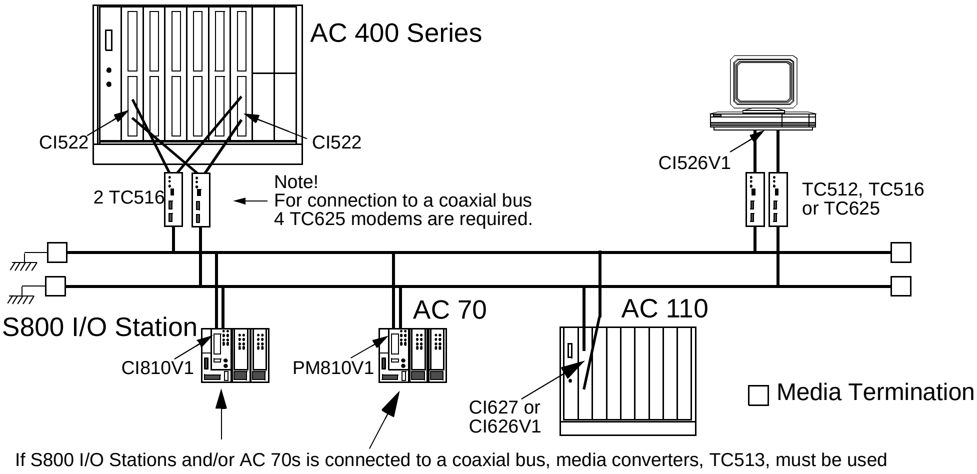

AC 400 Series
CI522
CI522
2 TC516
Note!
For connection to a coaxial bus
4 TC625 modems are required.
CI526V1
TC512, TC516
or TC625
S800 I/O Station
AC 70
AC 110
CI810V1
PM810V1
CI627 or
CI626V1
☐ Media Termination
If S800 I/O Stations and/or AC 70s is connected to a coaxial bus, media converters, TC513, must be used

Figure 7-11. Communication interface redundancy on Advant Fieldbus 100

S800 I/O Fieldbus Communication Interface redundancy

S800 I/O FCI redundancy is achieved by using two CI820s, together with a TB815 unit, connected to a media redundant bus.The redundant S800 I/O station communication interfaces are attached to one of the redundant AF 100 cables each, see Figure 7-12. Communication on cable 2, from the CI820 attached to cable 1, and vice versa, is performed via a cross communication link on the TB815. To achieve highest availability redundant S800 I/O FCIs are used together with redundant CI522s.

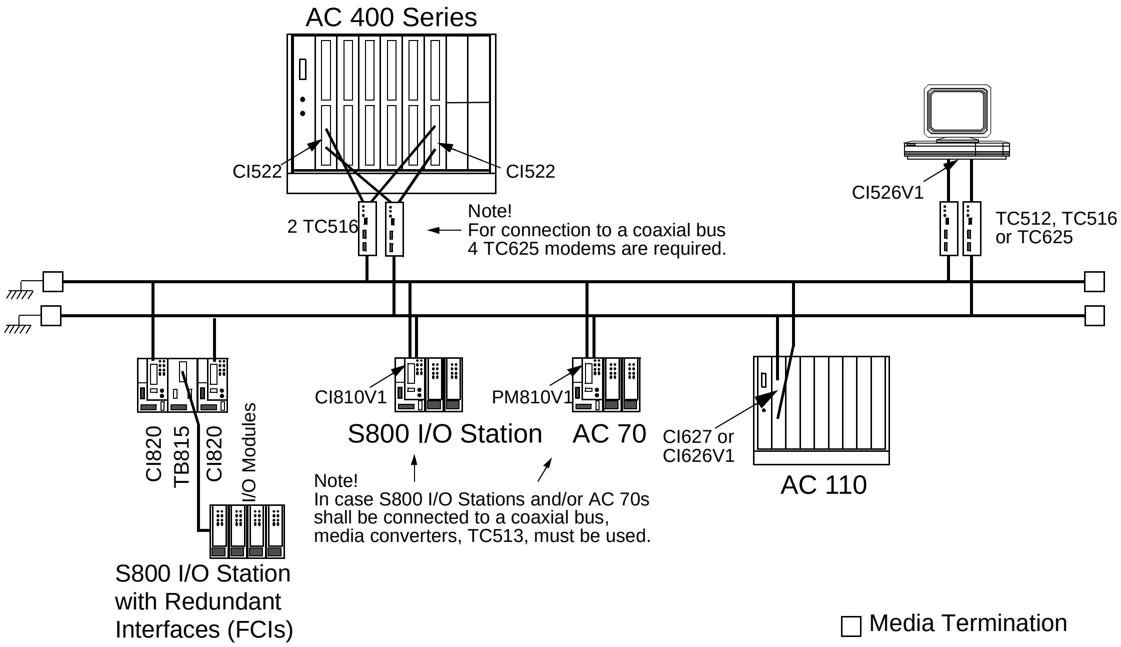


Figure 7-12. S800 I/O station redundancy on Advant Fieldbus 100

7.2.2 RCOM/RCOM+

Outline Description

Remote COMmunication (RCOM/RCOM+) provides multidrop, point-to-point or telecommunication capabilities (for example, dial-up connections over public telephone networks).

Traffic on an RCOM/RCOM+ link is controlled by a communication master. Direct communication is only possible between the master and the communication slave devices. Stations connected via RCOM/RCOM+ appear in the Advant OCS system as stations on a local MasterNet control network.

The difference between RCOM and RCOM+ is that RCOM uses a Break character to alert a slave, while the RCOM+ protocol uses a character time-out. The character time-out is a configurable number of character transmission times. RCOM+ also supports a transfer of up to 24 DATs and a safer checksum calculation (CRC 16). RCOM+ should be used together with modems that do not reproduce the Break character.

NOTE

The RCOM protocol has to be used when communicating with MasterPiece 40.

The following RCOM/RCOM+ functions are examples of functions performed in master mode:

- Polling of event from the slaves
- Read and Write command to the salves
- Clearing of the event queues and Setting of the clocks in the slaves
- Blocking and Deblocking of the slaves

The data transfer is performed using packets of data (Data Sets). Time stamped events can also be transferred from slave to master.

Network Configuration

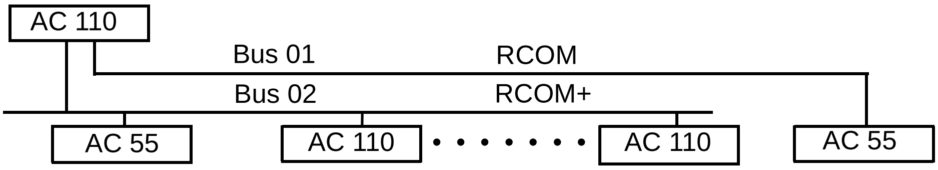


Figure 7-13. An RCOM /RCOM+ configuration

Up to eight slave nodes can be connected in an RCOM/RCOM+ configuration with Advant Controller 400 Series, and up to 25 slave nodes for Advant Controller 55 and Advant Controller 110.

Performance

RCOM/RCOM+ operates at speeds up to 19.2 kbits/s. Communication speed and data throughput depends on the physical media for communication, and the controller in which the RCOM/RCOM+ interface resides.

7.2.3 Profibus-DP

Outline Description

PROFIBUS is a set of international fieldbus standards included in the European standard EN 50 170. Within the PROFIBUS family of protocols, PROFIBUS-DP is optimized for high speed and inexpensive hookup. It features reliable, cyclic data transfer.

PROFIBUS-DP is designed especially for communication between automation control systems and distributed I/O at the device level.

Network Configurations

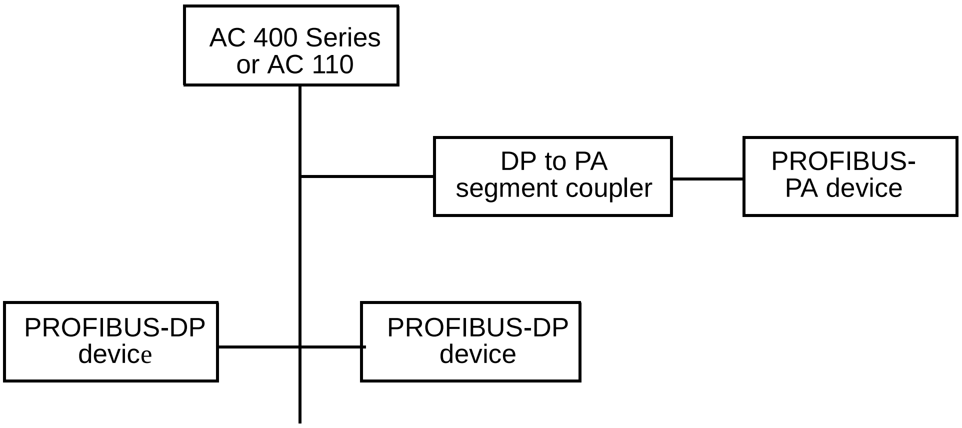


Figure 7-14. PROFIBUS-DP configuration example

Up to 125 slave nodes can be connected to one bus. Up to eight buses can be configured in an Advant Controller 450.

Characteristics

Advant PROFIBUS-DP interface is a PROFIBUS-DP Master (class 1) according to EN 50 170. It can be used to interface any certified PROFIBUS-DP slave device. In addition, there is support for:

- PROFIBUS-DP/V1 data types, for example, floating point
- Reading of input data, output data and diagnostics from a PROFIBUS-DP slave device owned by another PROFIBUS-DP master.
  This requires that the PROFIBUS-DP slave device supports these additional (class II) sevices and product revision “E” or later of CI541V1.

Field devices using the PROFIBUS-PA protocol can be connected to Advant OCS’s PROFIBUS-DP solution via an external segment coupler.

Bus length, Media and Segments

The bus length depends on the selected baudrate, but varies from 100 m (330 feet, 12Mbit/sec.) up to 1200 m (3900 feet, 9.6 kbit/sec.). Cable length can be increased by using repeaters. We recommended to not use more than three repeaters in series between two devices, according to EN50170. Twisted pair (twp) cable media is supported.

The bus can be built up by several segments and by this allowing distances longer than 1200 m (3900 ft.) For twisted pair media, 32 stations can be connected to each segment. Different segments are interconnected with repeater modems which allows change of media type or can serve as galvanic isolation.

Performance

PROFIBUS-DP can be configured to operate from 9.6 kbit/sec to 12 Mbit/s. Higher bit rate gives higher throughput, but decreases the maximum cable length per segment. The performance of a PROFIBUS-DP bus depends on the number of devices connected. The basic bus cycle time is 10 milliseconds.

Configured PROFIBS-DP slaves can be disconnected from the bus and replaced without disturbing other units or their communication with Advant Controller 400 Series. Communication with a reconnected unit is resumed automatically.

Hardware

The hardware for the Advant PROFIBUS-DP interface consists of the CI541V1 communication interface. The CI541V1 occupies one slot in an SC510 or SC520 submodule carrier.

7.2.4 LONWORKS Network

Outline Description

LONWORKS is an open fieldbus which has been designed to be used as a control network. Is is characterized by multiple communications media, multivendor equipment, low maintenance cost, and very low per node cost. It features event handling and event driven or cyclic data transfer.

Network Configurations

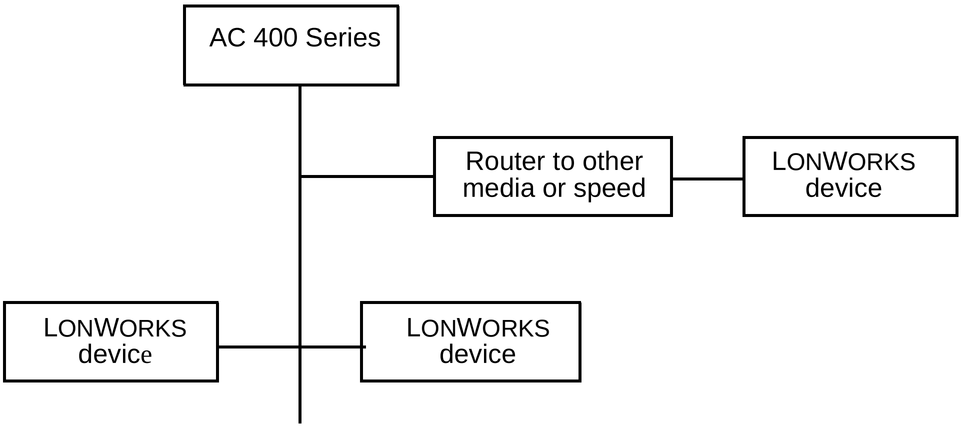


Figure 7-15. LONWORKS network configuration example

Up to 128 devices can be superviced one network. Up to eight LONWORKS networks can be configured in an Advant Controller 450.

Characteristics

Advant interface to LONWORKS networks can be used to interface to any LONMARK compatible device. The network can be extended with repeaters, routers, and gateways all according to LONWORKS technology.

Bus length, Media and Segments

The bus length depends on the speed, number of devices, and media used but varies from approximately 130 meter (twisted par @ 1.25 Mbit/sec.) to 1400 meter point-to-point (twisted pair @ 78 kbit/sec.). Depending on media and number of devices connected, the network can be extended using repeaters and routers.

Performance

Bus speed is 1.25 Mbit/sec. for CI572 and 78 kbit/sec. for the CI573 interface. Number of messages that can be received is approximately 200 messages per sec. and channel including both data and events.

Hardware

The hardware for the Advant interface to LONWORKS networks consists of the CI572 or CI573 communication interfaces. The CI572/573 occupies one slot in the SC510 or SC520 submodule carrier.

7.2.5 Multi Vendor Interface

Multi Vendor Interface (MVI) is used for communication with third party control equipment. Stations connected via MVI appear in Advant OCS as nodes on a local MasterNet control network. Advant OCS supports the following protocols:

- Modbus

  MVI modules CI532V02 or CI534V02
- Siemens 3964(R)

  MVI module CI532V03
- Allen-Bradley DF1

  MVI module CI534V04

For Advant Controller 110/410/450 information is handled as MVI-datasets and administrated (flow-controlled) via an AMPL program developed for the application in question.

7.2.5.1 MVI - MODBUS

Outline Description

CI532V02 (AC 110 and AC 400 Series) and CI534V02 (AC 400 Series release 1.3 or later) are asynchronous communication modules used to connect MODBUS communication links to the Advant OCS system. The connection is point-to-point or multidrop. The interface can act as either master or slave. Both RTU (binary) and ASCII modes are supported.

The MVI module CI532V02, can handle up to 8 nodes on each port. As communication master the MVI module CI534V02, can handle a total of 55 slave nodes, divided on two ports. One single port can handle up to 32 slave nodes.

The MVI module can handle up to two independent communication ports. Each port forms a local control network in MasterNet. The following MODBUS functions are supported:

- 01 = Read coil status
- 06 = Load single register
- 02 = Read input status
- 07 = Read exception status
- 03 = Read holding register
- 08 = Diagnostic loopback (Diagnostic code 0)
- 04 = Read input register
- 15 = Force multiple coils
- 05 = Force single coil
- 16 = Load multiple register

The implementation is made for:

- master and slave mode
- point-to-point and multidrop connections

Network Configuration

For distance up to 15 m (49 ft.) MVI-MODBUS can be used without modems, assuming that it can be guaranteed that the CMV will stay below ± 7 V at all times. However, modems should always be used to minimize disturbance. With modems, the distance can be up to 1000 m (3280 ft.) at 19.2 kbit/s, using either a point-to-point modem (for example, DSTC X008 Westermo MA12) or a multidrop modem (for example, Westermo LA-01).

Performance

MVI-MODBUS operates at speeds up to 19.2 kbit/s. The communication speed and data throughput depends on the controller in which the interface resides, and the connected external control system.

7.2.5.2 MVI - Siemens 3964(R)

Outline Description

CI532V03 is an asynchronous communication module for connecting Siemens 3964(R) communication links to Advant OCS. The connection is point-to-point. The MVI module supports Siemens 3964 (no checksum) and Siemens 3964R (with checksum). It can handle up to two independent communication ports. Each port forms a local control network in MasterNet. The following Siemens 3964(R) functions are supported:

- Send memory data
  - AS = Absolute address

  - AM = Flag bytes
  - AD = Data block
  - AZ = Counter location
  - AE = Input bytes
  - AT = Timers
  - AA = Output bytes
- Fetch memory data
  - ES = Absolute address
  - EM = Flag bytes
  - ED = Data block
  - EZ = Counter location
  - EE = Input bytes
  - ET = Timers
  - EA = Output bytes

The implementation is made for

- Siemens 3964 (no checksum) and Siemens 3964R (checksum)
- Quasi full duplex mode
- Subordinate and superior (low and high priority)

Network Configuration

For distance up to 15 m (49 ft.) MVI-Siemens 3964(R) can be used without modems, assuming it can be guaranteed that the CMV will stay below ± 7 V. However, modems should always be used to minimize disturbance. The distance between the modems can be up to 1000 m (3280 ft.) at 19 200 bps, with a point-to-point modem (for example, DSTC X008 Westermo MA12).

Performance

MVI-Siemens 3964(R) operates up to 19.2 kbit/s. Communication speed and data through-put depends on the controller in which the interface resides and the external control system.

7.2.5.3 MVI - ALLEN-BRADLEY DF1

Outline Description

CI534V04 is an asynchronous communication module used to connect Allen-Bradley communication links to the Advant OCS system. The MVI module can be connected via different Allen-Bradley network interfaces (e.g. KE/KF2) to different types of Allen-Bradley DataHighway networks (e.g. DH or DH+). The Allen-Bradley network interface converts the RS-232-C (MVI Allen-Bradley DF1 protocol) to the appropriate network.

The MVI module CI534V04, can handle a total of 50 slave nodes, divided on two ports. One single port can handle up to 31 slave nodes. If the traffic intensity is high towards some of the RTUs, the performance may be decreased.

The MVI module can handle up to two independent communication ports. Each port forms a local control network in MasterNet. The following Allen-Bradley DF1 functions are supported:

- For PLC2:
  - Protected Write
  - Unprotected Write
  - Protected Bit Write
  - Unprotected Bit Write
  - Unprotected Read
- For PLC5:
  - Word Range Write
  - Word Range Read
- For SLC503/504:
  - Protected typed logical write with three address fields
  - Protected typed logical read with three address fields

The implementation is made for:

- Allen-Bradley DF1 protocol
- MVI only acting as communication master
- Supported checksum calculation is BCC.

Network Configuration

For distance up to 15 m (49 ft.) between MVI module and Allen-Bradley network interface, MVI Allen-Bradley DF1 can be used without modems, assuming it can be guaranteed that the CMV will stay below ± 7 V. However, modems should always be used to minimize disturbance. The distance between the modems can be up to 1000 m (3280 ft.) at 19.2 kbit/s, with a point-to-point modem (for example, DSTC X008 Westermo MA12).

Performance

MVI Allen-Bradley DF1 operates at speeds up to 19.2 kbit/s. The communication speed and data throughput depends on the controller in which the interface resides, and the connected external control system.

7.3 OPC Server for Advant Fieldbus 100

Introduction

The Advant OPC Server for Advant Fieldbus 100 is a standard OPC interface for Advant Fieldbus 100, based on the Windows NT operating system. The Advant Fieldbus OPC Server enables data exchange between Windows applications and stations on the Advant Fieldbus 100 network. The Advant Fieldbus OPC Server can be used by client applications with support for the mandatory custom interface, the automation interface and the alarms and events interface according to the OPC Foundation standard. The Advant OPC Server for Advant Fieldbus 100*1.1 includes support of the OPC Automation Interface based on the OPC Data Access Specification 1.0A for higher level applications developed in for example Visual Basic for applications.

This version also includes the alarm and event functionality according to the OPC Alarms and Events Specification version 1.0, i.e. the Advant OPC Server for Advant Fieldbus 100*1.1 can be configured to receive time tagged events from the Advant Fieldbus 100 network.

Positioning and Features

The Advant OPC Server for Advant Fieldbus 100 provides OPC client applications, such as Human Machine Interface (HMI) products or custom-built applications, access to process objects in Advant Controllers (AC160, AC110, AC70 and AC80[1]). The Advant OPC Server can also be used together with the Advant Controller 400 Series controllers with limited functionality.

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[1] Not verified in Product Type Test.

Product Benefits

The Advant Fieldbus OPC Server provides an open standard interface, supporting any client package that uses the OPC interface. This allows you to use the Advant OPC Server for Advant Fieldbus 100 together with HMI products of your own choice, as OPC is supported by many 3rd party vendors of industrial PC software.

The Advant OPC Server for Advant Fieldbus 100 is well integrated with the AMPL Control Configuration product. The Advant OPC Server for Advant Fieldbus 100 can directly use the object configuration data from the AMPL Control Configuration. I.e. you only need to enter object configuration data once to configure both the controller nodes and the Advant OPC Server for Advant Fieldbus 100.

Chapter 8 Configuration Language AMPL

Process control applications are configured in ABB MasterPiece Language (AMPL). AMPL is a function-block language with graphic representation, especially developed for process control applications. It is similar to the standard IEC1131-3, Function Block.

AMPL is characterized by each function being seen as a building block with inputs and outputs. The function of a block can be simple; a logic AND function, or complex; a complete adaptive PID regulator. A program written in AMPL is referred to as an AMPL program and the building blocks are called PC elements. The range of ready-to-use PC elements is wide and powerful.

Control loops can be combined with motor control, start-up, and shut-down sequences and fast interlocking logic (with cycle time down to 10 ms), all in the same control program and using the same high-level function block oriented language, AMPL.

A controller can be configured in AMPL fully on-line, that is, with the programs running and controlling the process. If required, a part of an AMPL program, a complete AMPL program or the whole controller can be blocked during configuration. It is also possible to develop programs off-line in an engineering station and later load them into the controller.

In addition to functional PC elements, AMPL contains several structural elements for division of an AMPL program into suitable modules. The modules can be managed and executed individually. The modules can be given different cycle-times and priorities so that both fast and slow control operations can be managed by the same AMPL program.

The inputs and outputs of an element are connected to the inputs and outputs of other elements or to process I/O points. Picking these elements and making these connections constitute the configuration work. The resulting AMPL program can then be documented graphically. Figure 8-1 shows an example.

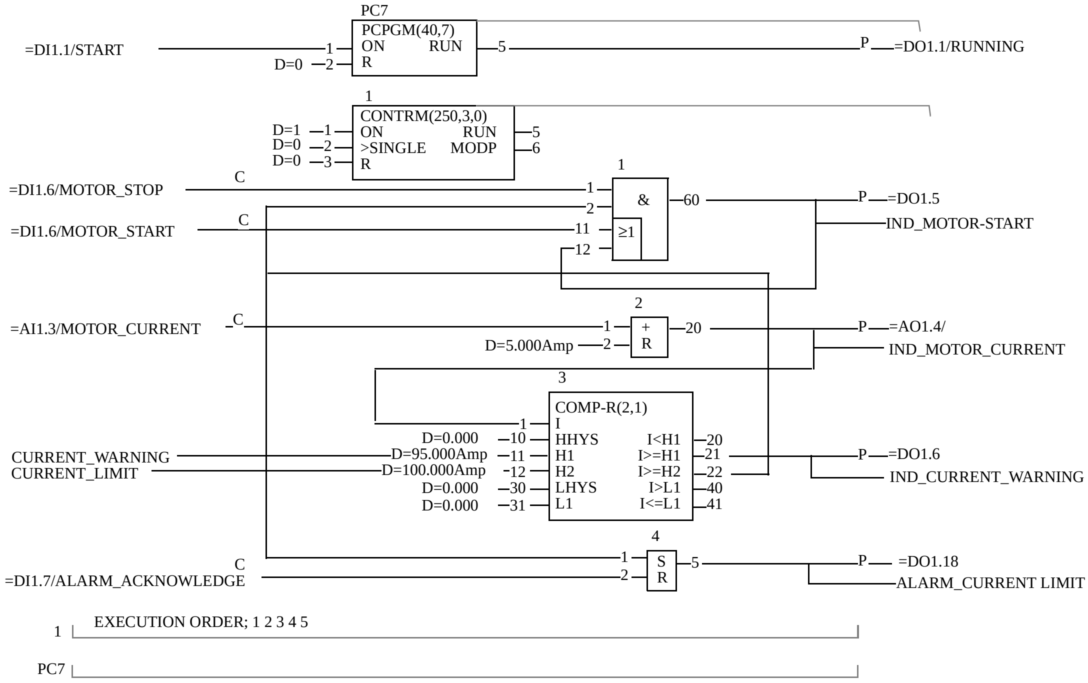

Figure 8-1. Example of automatic AMPL document printout

The engineering products support type circuits; standard solutions to control problems in an application area or in a specific application project. A type circuit may comprise all the functions to control motors, pumps, valves, temperature loops, etc., including all the necessary definitions for I/O and operator communication. It can be tested and corrected before it is multiplied. This means optimization of engineering work by using standard solutions.

Advant OCS supplies very powerful control functions for the optimum solution. One of them is the PIDCONA multipurpose PID regulator. Some of its most powerful features are:

- True auto-tuning, without any pre-setting parameters
- Continuous adaptation during plant production
- Automatic selection of PI or PID function
- Multi-zone parameter scheduling with or without continuous adaptation
- Pre-configured for easy use in control solutions, such as cascade control, gap control, error squared on integral or ratio control
- Various limitation options for setpoint via amplitude or rate of change
- Supervision and alarm of feedback signal via the regulator
- Automatic tracking for bumpless transfer at mode change
- Built-in mode change handling with priority scheduling
- Limit supervision via event and alarm handling
- Powerful user interface for the operator.

PIDCON, a similar regulator without any adaptive features is also available.

Yet another regulator NOVATUNE supplies continuous adaptation during plant production. The extra features of this regulator is continuous adaptation of a feed forward signal. NOVATUNE is not a PID regulator. It is based on a Least-Squares Minimum Variance regulator extended with pole placement features. Adaptive feed forward means that the influence of the process disturbance on the process variable can be minimized or eliminated. NOVATUNE has built-in deadtime compensation on top of the adaptive feed forward extension.

PIDCONA, PIDCON, and NOVATUNE are also PC elements in the AMPL. It is easy to combine a loop controller with supplementary functions, such as interlocking, start-up and shutdown sequences, calculations, process optimization, etc. In a similar way, high-level function units are available for applications such as valve control or group control of motors.

Chapter 9 Environmental Immunities for Advant OCS Products

The immunity of Advant OCS to environmental factors is summarized in this section.

Advant OCS products are designed to withstand the environments encountered in the power and process industries with respect to climatic, mechanical and electrical effects.

Products in the Advant OCS range, manufactured by ABB or others, are normally type tested or evaluated to ensure compliance with the environmental requirements specified below.

These requirements can be categorized as follows:

- Resistance to the external environment outside enclosures (including corrosive gases)
- Resistance to the environment inside enclosures
- Electro Magnetic Compatibility
- Electrical safety.

The environmental specifications applicable to peripheral equipments, for example, printers, may differ. Refer to the data sheets of the products concerned.

The degree to which the units withstand environmental influence depends on their components and their design. The system enclosures, the types of cable and how these are routed determine the environmental requirements of the complete system.

9.1 Corrosive Gases

Advant OCS products are specified for environments with copper reactivity of 300 Angstrom over 28 days, according to ISA-S71.04-1985 class G1 and ITF SSG 4251 class G1.

Some products are even specified for environments with copper reactivity of 1000 Angstrom according to class G2, for example, S800 I/O, see product data.

If this value is exceeded, protective measures must be taken, for example, encapsulation, dehumidification or gas cleaning with chemical filters.

9.2 Resistance to the External Environment

Advant OCS products in standard cabinets satisfy the environmental requirements specified in the following tables. This ensures a long life for the system in normal industrial environments. If Advant OCS products are to be used in more severe environments, special cabinets should be considered.

9.3 Environmental Conditions

The environmental conditions apply to:

C = Cabinets (Enclosures, Cases, Consoles) to protection class IP21 (according to IEC 529)
U = Units (Subracks, plug-in units, printed circuit boards)

Environmental Factors, Transportation and Storage

Requirement		**Standard complied with**							
Environment	**Limits**	**IEC 1131 -2**		**VDE 0160**		**IEC 721 -3**		**IEC 654**	
		Req.	**Test**	**Req.**	**Test**	**Class**	**Class**	**Point**	**Class**
Temp., no package (C+U)	Low -40 °C High +70 °C (1)	2.3.1 2.3.1	6.3.4.2 6.3.4.2	5.2.1.1 5.2.1.1	- -	1 K5 1 K5	2K4 2K4	4.3 4.3	Part 1 C2 Part 1 C2
Temp. change, no package (C+U)	-25...+70 °C (1)	2.1.1.2	6.3.4.3	-	-	1 K5	2K4	5.1	-
Humidity, no package (C+U)	RH=5-100%, condensing (2) (3)	2.3.2	6.3.4.4	5.2.1.2	7.2.1	1K5	2K4	4.3	C2
Bump, no package (U)	100 m/s^2, 6 ms, x, y, z direction (2)	-	-	-	-	1M3	2M1	-	Part 3:5
Bump, no package (C)	100 m/s^2, 6 ms, Z direction	-	-	-	-	1M3	2M1	-	Part 3:5
Fall, in package (C+U)	<10 kg, 1 m x, y, z direction 10-40 kg, 0.5 m x, y, z direction >40 kg, 0.25 m x, y, z direction	2.3.4	6.3.5.4	-	-	-	2M1	-	Part 3:5
Altitude (C+U)	3000 m	2.3.3	-	5.2.1.3 (4)	-	1K5	2K4	-	-

(1) For Advant Station 100 Series engineering stations, the following values apply: Low: -25 °C, High: +60 °C; changes in temperature not specified
(2) For disk drives, following applies: Humidity (RH): 5-95%, non-condensing (transportation); Vibration: 2.5 m/s2, 5-200 Hz (peak swept sinus); Shock: 25 m/s2, 10 ms.
(3) For Advant Controller 110, the following value applies: Humidity (RH): 5-95%.
(4) 3265 m

NOTE

All verifications are done according to applicable standards, for example, IEC 68-2-1, -2, -3, -6, -13, -14, -27, -29, -30, -32.

Environmental Factors, Operation

Requirement		Standard complied with							
Environment	**Limits**	**IEC 1131 -2**		**VDE 0160**		**IEC 721-3**		**IEC 654**	
		Req.	**Test**	**Req.**	**Test**	**Class**	**Class**	**Point**	**Class**
Temperature									
(C)	Low, non-condensing (1) 0°C	2.1.1.1	6.3.3	5.2.1.1	-	-	3K4	4.2	Part 1, B3
	High +40 °C	2.1.1.1	6.3.3	5.2.1.1	-	-	3K4	4.2	Part 1, B3
(U)	Low, non-condensing (2) 0°C	2.1.1.1	6.3.3	5.2.1.1	-	-	3K4	4.2	Bx
	High +55 °C	2.1.1.1	6.3.3	5.2.1.1	-	-	3K4	4.2	Bx
Temperature gradients (2) (C+U)	±3 °C/min	- -	6.3.4.3 6.3.4.3	- -	- -	- -	3K4 3K4	5.1 5.1	Part 1:5.1
Humidity (C+U)	RH=5-95%, abs. 1-29 g /m^3, non-condensing (2)	2.1.1.3 level RH-2	-	5.2.1.2	-	-	3K4	4.2	Part 1 B3
Vibration									
(C)	±0.075 mm, 10- 57 Hz, 10 m/s^2, 57-150 Hz, x, y, z direction	2.1.3.1	6.3.5.1	5.2.2	7.2.2	-	3M4 (3)	-	Part 3 V.H. 3
(U) (2)	±0.15 mm, 10-57 Hz, 20 m/s^2, 57 -150 Hz, x, y, z direction	2.1.3.1	6.3.5.1	5.2.2	7.2.2	-	3M4 (3)	-	V.H.4
Shock (C+U)	150 m/s^2, 11 ms, half sine, x, y, z direction (2)	2.1.3.2	6.3.5.2	5.2.2	-	-	3M4	-	Part 3:5
Altitude (C+U)	2000 m	2.1.1.6	-	5.2.1.3	-	-	3K4 (4)	-	-
Pollution degree (C+U)	Degree 2 acc. to IEC 664 and 664A	1.4.42 2.1.1.4	-	5.2.1.4	5.7.2.3	3S2	-	-	-
Emitted noise (C)	<55 dB(A)	-	-	4.2	7.2.5	-	-	-	-

(1) For Advant Station 100 Series engineering stations, the low temperature limit is +5 °C

(2) For units with disk drives, the following values apply: Temperature 10-40 °C, Humidity 20-80%; Vibration: 2.0 m/s^2, 5-200 Hz; Shock: 25 m/s^2, 10 ms.

(3) Not across the whole range.

(4) 70 kPa

NOTE

All verifications are done according to applicable standards, for example, IEC 68-2-1, -2, -3, -6, -13, -14, -27, -29, -30, -32.

9.4 Electromagnetic Compatibility and Electrical Safety

From 1 January 1996 most electrical and electronic products made, sold or taken into service within EU and EFTA must have a CE marking with regards to the EMC directive. The purchaser must be aware of the responsibility, with respect to the law of EMC, taken over by ordering not CE marked products from the factory. The responsibility refer to relevant EMC tests, approval and documentation. By later completion and reconstruction of standard CE marked equipment the responsibility of the CE marking is also taken over by the one making the changes.

From 1 January 1997 all electrical material for sale within EU/EFTA must carry a CE marking with regards to the EMC and the Low Voltage directives, and all apparatus and systems connected to the public telecommunication network must also carry the CE marking with regards to the Teleterminal directive.

NOTE

Market outside EU/EFTA does not normally require CE marked products.

Advant OCS products meet the requirements in EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC (relevant products also fulfil the Teleterminal Directive). The products have a CE marking and a Declaration of Conformity, normally enclosed in the product delivery. Some products require enclosure, specified in User’s Guide, to meet the EMC Directives. Compliance is verified by the application of minimum the following directives and standards:

- EMC Directive 89/336/EEC
  - EN 61131-2 Product standard, Programmable controllers
  - EN 50081-2 Generic emission standard, Industrial environment
  - EN 50082-2 Generic immunity standard, Industrial environment

Requirements According to EMC Directive 89/336/EEC

Requirements	Standard	Level
EMISSION		
- Radiated and Conducted	EN 55011	Class A
IMMUNITY		
- Radiated RF field	ENV 50140 ENV 50204 IEC 1000-4-3	10V/m (1)
- Conducted RF voltage	ENV 50141 IEC 1000-4-6	10V (2)
- ESD (Electrical Discharge)	EN 61000-4-2	4 kV contact discharge 8 kV air discharge
- EFT/B (Electrical Fast Transient/Burst)	EN 61000-4-4	2 kV
- Power frequency magnetic field	EN 61000-4-8	30 A/m (3)

(1) 3 V/m for ITU broadcast frequency band
(2) 3 V for ITU broadcast frequency band
(3) 3 A/m for monitors

- Low Voltage Directive 73/23/EEC
  - EN 60950, EN 61010, EN 50178, EN60439 depending on the product.

  Conformity on the Low Voltage Directive is maintained by the use of good engineering praxis in the electrical safety matters based on the ABB internal Electrical Safety Directive 3BDU000002 which was reviewed by KEMA. Production control follows the ISO 9000 regulations and includes required electrical safety routine tests.
- Teleterminal Directive 91/263/EEC

9.5 Mains Voltage and Mains Frequency Tolerance

Supply	Requirements
Mains voltage a.c.	U_{nom}, -15% to +10%
Mains frequency a.c.	47 - 63 Hz
Overvoltage Category	Class III (Permanently connected equipment) (1)

(1) Non-permanently connected equipment: Class II

High Voltage Switchgear Applications

Advant OCS are intended for normal industrial environment as specified in this data sheet.

For other environments external measures must be taken.

9.6 Lightning Stroke Protection

Industries and power plants are normally equipped with well integrated earthing networks which are installed as part of the power distribution system. In such installations it is not necessary to install additional protection against lightning stroke.

All I/O Boards are tested either according to IEC 255-4, impulse test 3kV or according to IEC 1000-4-5 class 3.

Additional protection against lightning stroke is always necessary when:

- Cables extend beyond the area covered by the earth line network
- Cables are located above ground
- Overhead cables are used.

9.7 Inductive Load Suppression

Inductive load such as relays and conductors directly connected to Advant OCS equipment do not have to be suppressed. The necessary suppression components (varistors or snubbers - RC units) are installed on the circuit boards.

9.8 Installation of Field Cables

There are no special requirements for installation of field and communication cables connected to Advant OCS, except cables for short-distance communication without modems should always be routed 100 mm (4 inches) away from other cables.

All cables connected to Advant OCS should be run 300 mm (12 inches) away from power cables (heavy current cables) not belonging to Advant OCS products and 100 mm (4 inches) away from cables belonging to class 4 of relevant international immunity standards (for example, IEC 1000-4-x).

9.9 Types of Field Cables

Shielded cables (if not other are specified) are always required for:

- Communications (see product documentation for the type of cable)
- High-frequency pulse transmission (see product documentation for the type of cable)
- Low level analog signals, for example, Pt100 and thermocouples
- Analog application with a system accuracy $\geq$ 12 bits

For other applications it is possible to use unshielded cables. Digital and analog signals of the same type can be run in the same cable.

Signal and return conductor are always to be located in the same cable.

9.10 Installation Instructions

Installation rules for Advant OCS are included in relevant product documentation.

More information can be found in the ABB Industrial Systems AB publication *Interference-free Electronics*.

Ordering No:

3BSE 000 877R0001 (English)

3BSE 000 877R0002 (Swedish)

October 1996

Chapter 10 Cabinets and Peripherals

10.1 RH500 Cabinets

General

The RH500 cabinet (available in three protection classes) is used for installation of Advant Controller 400 Series in control rooms. Two protection classes are ventilated, and complies with IEC 529 protection class IP21, and IP41. The third protection class has no ventilation and complies with IEC 529 IP54 (category 2). See Table 10-2.

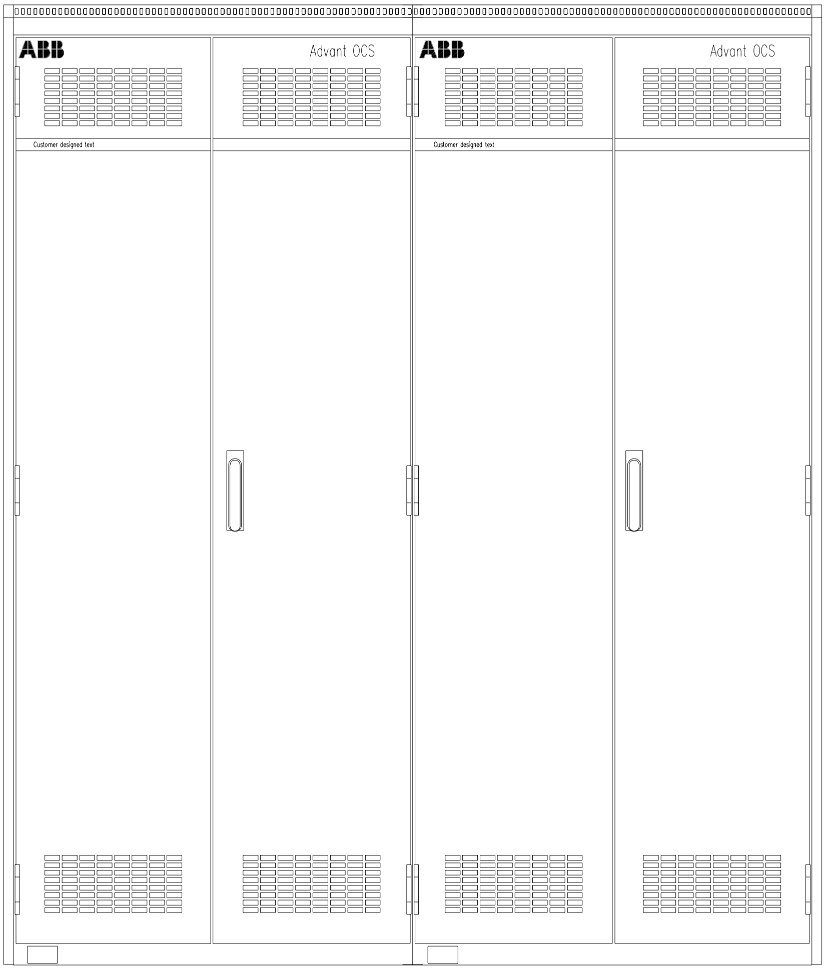

Figure 10-1. RH500 Cabinet - Front View

The cabinets are delivered in a light grey RAL 7035 structure color.

A grounding point (an M10 screw) is located towards the front of the cabinet in the left C-profile.

Three cabinet types are available:

- cabinets
- cabinets with hinged frame, and
- cabinets for OOCU.

Dimensions and Weight

The dimension and weight of the RH500 cabinets are given in the table below.

Table 10-1. RH500 Cabinet Measurements

Characteristics - Cabinet Type RH500	
Dimensions	
Cabinet(1) WxDxH	800x555x2012 mm (31.5x21.8x79.2 inch.)
End Panel(2) W1xD1	15x536 mm (0.6x21.1 inch.)
Cable Entry W2xD2 (3x)	214x275 mm (8.4x10.8 inch.)
Weight(3)	
Cabinet	150-200 kg (330-440 lb.)
End Panel	15 kg (33.1 lb.)
Doors	Double
Mounting Planes	19”/24”
U-Modules Cabinet/Hinged Frame	40U/40U
Swing Radius(4)	
Double Door (**DD**)	365 mm (14.3 inch.)
Subrack (S100 I/O) in Hinged Frame (**SR**)	**AC410** = 535 mm (21.1”)
	AC450 = 495 mm (19.5”)

(1) The dimensions includes door and rear plate. If lifting angles are used add 53 mm (2.1”) to the height.
(2) W1xD1 shows the dimension for a single end panel. When mounting two end panels to a cabinet add 2x15 mm at the cabinet width.
(3) The weight does not include equipment to be installed within the cabinet.
(4) The space required for door(s) and the hinged frame. See Figure 10-2.

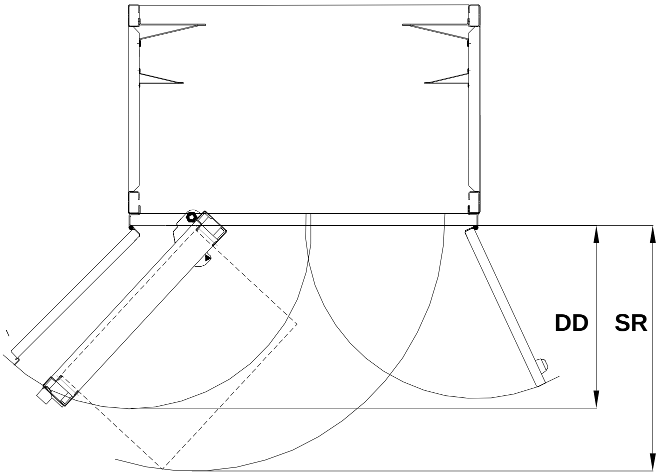

Figure 10-2. Swing Radius for Door(s) and Hinged Frame

Protection Rating

Cabinets are available for different environmental protection classes according to IEC529, see Table 10-2.

Table 10-2. RH500 cabinet protection classes

Type	Protection Class
Ventilated(2)	IP 21
Ventilated(1)	IP 41
Sealed	IP 54 (category 2)
Sealed with heat exchanger (2)	IP 54 (category 2)

(1) Ventilation grilles are covered with metallic net to prevent insects to enter the cabinet. A heater is included to heat the cabinet when the controller is not in use.

(2) Available as a standard sealed cabinet with heat exchanger as an option.

Permitted Power Dissipation

The permitted power dissipation in a single RH500 cabinet is given in Table 10-3 If required, due to environmental conditions, use Protection Class IP54.

Table 10-3. Permitted Power Dissipation for RH500

Protection Class	15^o C Temperature Rise	30^o C Temperature Rise
IP21	700 W	1.400 W
IP41	500 W	1.000W
IP54	300 W	600 W

The CPU subrack is provided with a fan unit to equalize the temperature difference in the subrack.

10.2 Control Desk Furniture

A series of control desk furniture has been developed for the Advant Stations. At development of the furniture aspects about ergonomics, control room environment, choice of color scheme, installation, etc. have been taken into special consideration.

The available packaging options are:

- RE550 Operator table with manual adjustment, 700-1090 mm (27.6-42.9”). (see Figure 10-3 and Figure 10-4)
- RE551 Operator table with mechanical parallel control. 115 or 230 V, 12 mm (0.5”) per second at maximum load 300 kg (661 lbs.), 700-1090 mm (27.6-42.9”).
- RE552 Operator table with electrical parallel control. 115 or 230 V, 25 mm (1.0”) per second at maximum load 300 kg (661 lbs.), 700-1090 mm (27.6-42.9”).
- RE553 Extension table, pie 45 degrees.
- RE554 Monitor mounting bracket, adjustable 300 mm (11.8”).

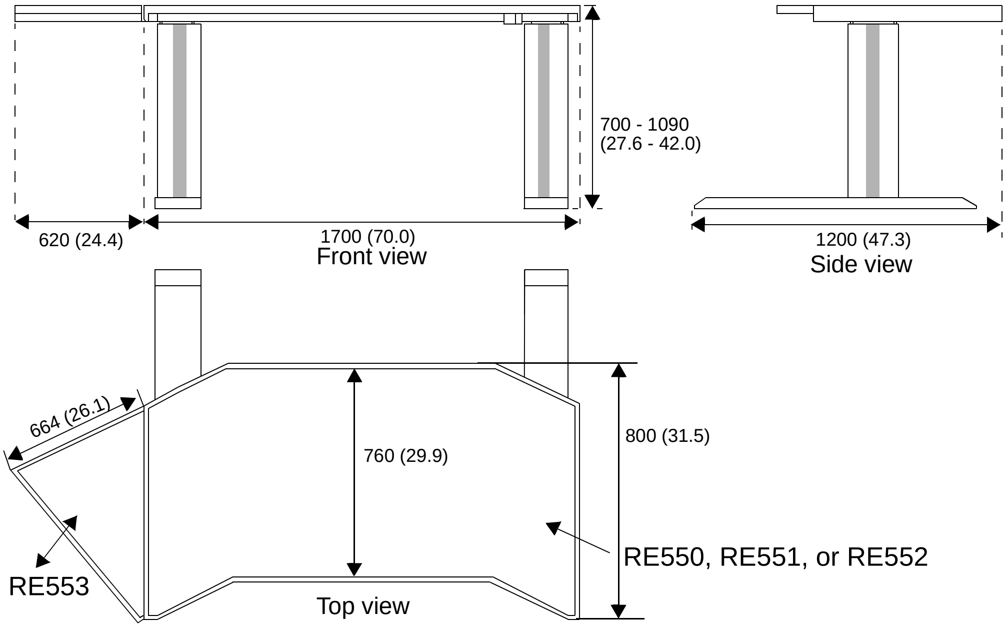

Figure 10-3. Operator table with extension table (measurements in mm and inches)

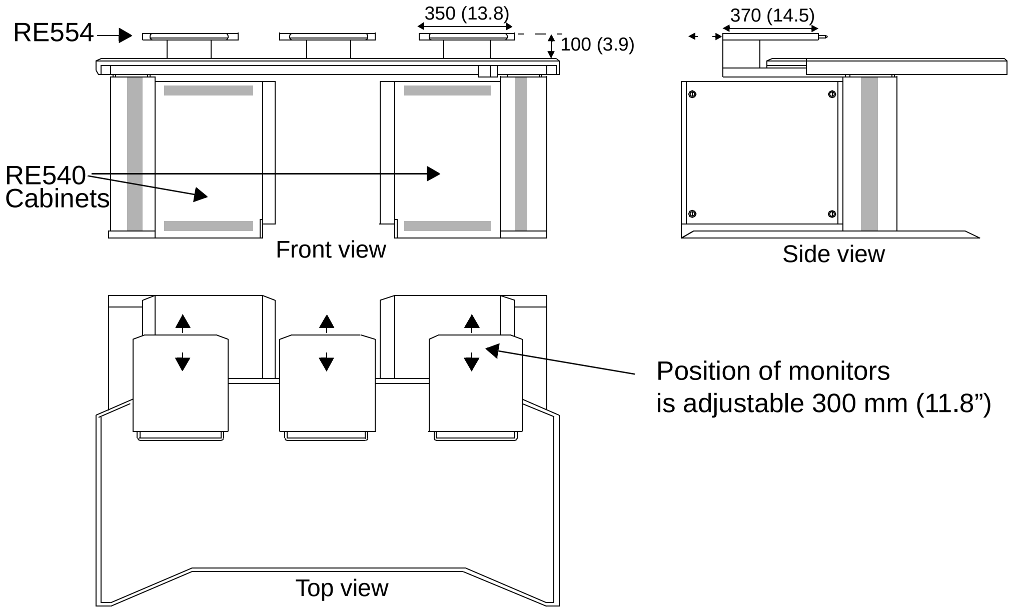

Figure 10-4. Operator table with cabinets and monitor mounting brackets

10.3 Printers

Printers are used in the Advant OCS system for various purposes, such as printout of screen hard copies from Operator Stations, reports, event lists and alarm lists, and for documentation of Advant Controller 400 Series application programs.

Table 10-4. Supported Printer Protocols

Printer	**Supported Protocols**		
	PCL5C	**Postscript**	**Epson**
Inkjet Printers			
HP Diskette 2500 CM with PCL5 option (EPX510)	Yes	Yes	No
Lexmark OptraColor 45 (EP515)	Yes	Yes	No
Laser Printers			
HP LaserJet 8000 (EP526/527)	Yes	Yes	No
HP LaserJet 4000 (EP528/529)	Yes	Yes	No
Matrix Printers			
Tally T2030/9 (EP537/538)	No	No	Yes
Tally T2130/24 (EP539/540)	No	No	Yes

The following is a summary of new printers available from ABB. For ordering details, see the relevant product reference guide in this guide.

Table 10-5. Technical data on printer EP537 and EP538

EP537 and EP538 B/W printer	
Maker	Tally T2030/9
Intended use	- Advant Controller 400 Series report printouts. - Event and alarm lists from Operator Stations. - MasterAid 51 program listings. - Advant Station 100 Series Engineering Station program listings and graphic documentation
Printing width	89-203 mm (3.5-8 inch)
Printing speed	360 char./s
Duty cycle	600 pages per day (ppd)
Interface	Serial RS-232C and parallel
Power Supply	EP537; 110/120 V, 50/60 Hz, 60 VA (printing) EP538; 230/240 V, 50/60 Hz, 60 VA (printing)
Acoustic level	<55 dBA
Dimensions: (h x w x d) mm (inches)	206x485x245 mm (8.1x18x9.6 inch)
Weight	9 kg (19.8 lbs.)

Table 10-6. Technical data on printer EP539 and EP540

EP539 and EP540, Wide Alpha-Numeric printer	
Maker	Tally T2130/24
Intended use	- Advant Controller 400 Series report printouts. - Event and alarm lists from Operator Stations. - MasterAid 51 program listings. - Advant Station 100 Series Engineering Station program listings and graphic documentation. - AMPL diagrams
Paper width	75-406 mm (3-16 inch)
Color range	Black

Table 10-6. Technical data on printer EP539 and EP540 (Continued)

EP539 and EP540, Wide Alpha-Numeric printer	
Printing speed	Max. 330 char./s
Duty cycle	600 ppd
Interface	Serial RS-232C and parallel
Power Supply	EP539 110/120 V, 50/60 Hz, 60 VA (printing) EP540 230/240 V, 50/60 Hz, 60 VA (printing)
Acoustic level	<55 dBA
Dimensions: (h x w x d) mm (inches)	206x625x245 mm (8.1x24.6x9.6 inch)
Weight	11 kg (24.2 lbs.)

Table 10-7. Technical data on printer EP515

EP515, Hard Copy printer	
Maker	Lexmark OptraColor 45
Intended use	- Hard copy - Report printouts
Resolution	600x600 dots per inch (dpi)
Print cartridges	1 black, 1 color (cyan, magenta, yellow)
Printing speed	Black and white text: up to 8 pages per minute (ppm) Color: up to 4 pages per minute (ppm)
Print volume	5000 pages/month
Interface	Standard: two-way parallel (IEEE 1284) With optional CIX528 interface installed: Ethernet with 10Base-T (twisted pair) and 10Base-2 (BNC for thin coax.)
Power Supply	100-240 V AC (automatic selection) 50/60 Hz
Acoustic level	<47 dB(A) printing
Dimensions: (h x w x d) mm (inches)	247x563x277 mm (9.7x22.1x10.9 inch)
Weight	9 kg (19.8 lbs)

Table 10-8. Technical data on printer EPX510

EPX510, Hard Copy printer	
Maker	Hewlett Packard DeskJet 2500CM
Intended use	- Hard copy - Report printouts
Resolution	600x600 dots per inch (dpi)
Print cartridges	1 black, 1 cyan, 1 magenta, 1 yellow
Printing speed	Black and white text: up to 11 pages per minute (ppm) Color: up to 3 pages per minute (ppm)
Print volume	12000 pages/month
Interface	Two-way parallel (IEEE 1284), Ethernet with 10/100Base-TX (twisted pair) and 10Base-2 (BNC for thin coax). The HP TCP/IP interface card JetDirect J4100A is included.
Power Supply	100-240 V AC (automatic selection) 50/60 Hz
Acoustic level	<49 dB(A) printing
Dimensions: (h x w x d) mm (inches)	247x563x277 mm (9.7x22.1x10.9 inch)
Weight	27 kg (59.5 lbs)

Table 10-9. Technical data on printer EP526 and EP527

EP526 and EP527 Laser Printer	
Maker	Hewlett-Packard HP LaserJet 8000
Intended use	- Document printer - Report printouts
Paper format	A4 (210 x 297 mm) and US legal (8 x13,6”) A3 (297 x 420 mm)
Max. speed	24 pages/min at A4
Print volume	130000 pages/month
Duplex printing	With optional EP502 Duplex printing accessory
Dot resolution	600 x 600 dpi

Table 10-9. Technical data on printer EP526 and EP527 (Continued)

EP526 and EP527 Laser Printer	
Interface	Standard: Two-way parallel Centronics (IEEE 1284) With optional CIX514 TCP/IP interface installed: Ethernet with 10Base-T (twisted pair), 10Base-2 (BNC for thin coax), LocalTalk (mini-DIN).
Power supply	EP526; 120 EP527; 230
Power frequency	58-62 Hz at 120 V, 48-52 Hz at 230 V
Power consumption	300 W (typical at 100% through put) 100 W (in standby state) 45 W (in power-save mode)
Acoustic level	<55 dB(A) printing and <36 dB(A) at standby
Dimensions: (h x w x d) mm (inches)	540x540x520 mm (21.3x21.3x20.5 inch)
Weight	45 kg (99 lbs)

Table 10-10. Technical data on printer EP528 and EP529

EP528 and EP529 Laser Printer	
Maker	Hewlett-Packard HP LaserJet 4050
Intended use	- Document printer - Report printouts
Paper format	A4 (210 x 297 mm), US legal (8 x13,6”), and Letter.
Max. speed	16 pages/min.
Print volume	130000 pages/month
Duplex printing	With optional EP503 Duplex printing accessory
Dot resolution	600 x 600 dpi
Interface	Standard: Two-way parallel Centronics (IEEE 1284) With optional CIX514 TCP/IP interface installed: Ethernet with 10Base-T (twisted pair), 10Base-2 (BNC for thin coax), LocalTalk (mini-DIN).
Power supply	EP528; 120 V EP529; 230 V
Power frequency	58-62 Hz at 120 V, 48-52 Hz at 230 V

Table 10-10. Technical data on printer EP528 and EP529 (Continued)

EP528 and EP529 Laser Printer	
Power consumption	330 W (typical at 100% through put) 18 W (in standby state) 16 W (in power-save mode)
Acoustic level	<55 dB(A) printing and <36 dB(A) at standby
Dimensions: (h x w x d) mm (inches)	343x390x493 mm (13.5x15.4x19.4 inch)
Weight	17.8 kg (39.2 lbs)

10.4 Uninterruptible Power Supply

Uninterruptible Power Supply (UPS) protects sensitive electrical equipment, such as computers and workstations from surges, outages and other power-related problems. It protects them from problems associated with utility power of poor quality, or a complete loss of power. The UPS cleans the utility ac power, maintains a constant voltage and isolates the output to the critical load. An uncontrolled shut down, due to, for example, power fail, can result in a complete cold start. The Operator Station should have an Uninterruptible Power Supply (UPS) provided. It is recommended to have Un-interruptible Power Supply also for the IMS Stations.

The SV530/531 UPS is a true on-line-UPS, primary intended for Advant Workplaces, with a built-in battery bank. It conditions the raw mains and supplies continuous, clean one-phase power. While feeding the load the UPS also keeps the internal battery charged all the time. If utility power fails, the UPS will continue to supply clean power without any interruption at the UPS outputs.

The information from the UPS about power fail is sent to the Advant Workplace via RS-232. In the Operator Station the information can as an alternative be transferred via the external alarm unit MP 51. The status information outputs from the UPS can work either in relay mode or RS-232 mode. When powered up the UPS works in relay mode. In this mode the information is sent to the external alarm unit MP 51 and in this case the power status can be displayed as part of the system status information.

Table 10-11. Data on UPS SV530/531

Property	Data
Input voltage	SV530 120 V a.c. ± 15% SV531 230 V a.c. ± 15%
Input frequency	45 - 65 Hz
Output power	1250 VA / 900 W
Output voltage	SV530 120 V a.c. ± 3 % SV531 230 V a.c. ± 3 %
Output frequency	Synchronization to line ± 3 Hz Free-running ± 0.1 %
Back up time	minimum 10 minutes at 1000 VA / 700 W output power minimum 7 minutes at 1250 VA / 900 W output power
Dynamic response	±3%, 100% load change response time < 4ms
Inrush current	< 125 A
Storage without batteries	–20° to +60° C
Storage with batteries	0° to +35° C(1)
Dimensions: (h x w x d) mm (inches)	252 x 142 x 400 mm (9.9 x 5.6 x 15.7”)
Net weight	approx. 15kg (33 lbs.)

(1) For longer term storage, energize the UPS cabinet for approximately 8 hours every 90 days in order to maintain battery charge.

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